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Advertisement Index, see page xxxii.

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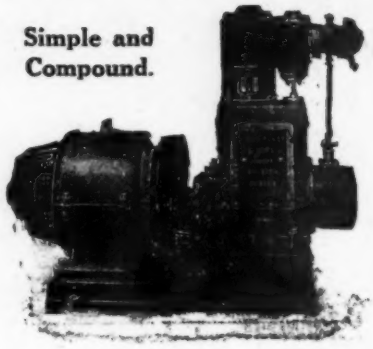

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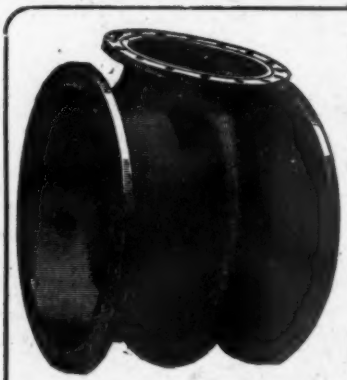

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ELECTRICAL REVIEW.

Vol. LXXXIV.] CONTENTS: March 7, 1919. [No. 2,154.

	Page
The Transport Bill	253
I.E.E. Informal Meetings	254
The Functions of a Trade Journal	254
Electricity Supply at Birmingham (*illus.*)	255
The Manager of Siemens-Schuckert on the Situation	258
Reconstruction: The Time for Clear Thinking and Straight Talking, by F. J. Maurice	259
Greater London Electricity Supply	259
New Electrical Devices, Fittings and Plant (*illus.*)	260
Legal	261
The Salaries of Electrical Staffs at Electricity Works	261
Business Notes	262
Notes	267
Reviews	271
City Notes	271
Stocks and Shares	274
The Determination of the Efficiency of the Turbo-Alternator, by S. F. Barclay and S. F. Smith (*illus.*)	275
The Faraday Society	277
Correspondence—	
A Three-phase Problem (*illus.*)	278
The Re-settlement of Officers	278
Telephone Calls at the Patent Office Library	278
Early Wireless Telegraphy	278
A Protective Association for Non-Technical Staffs	279
An Association for Technical Staffs	279
Electrical Engineering in the Army	279
Engineer Surveyors' Salaries	279
How Not to obtain a Situation	279
Electrified Seed	280
The Future of the E.T.U.	280
New Patents Applied for, 1918	280
Abstracts of Published Specifications	280
Contractors' Column	Advertisement page xxiv

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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

THE TRANSPORT BILL.

RARELY has a Government Bill been so anxiously awaited, and, when published, so little appreciated, as that which provides for the establishment of a new Ministry—the "Ministry of Ways and Communications, and for purposes connected therewith"—which was introduced into the House of Commons on Wednesday last week. The Bill is designed "for the purpose of improving the means of, and the facilities for, locomotion and transport," and empowers the Minister to take over all powers and duties of any Government Department relating to railways, tramways, waterways, roads, harbours, and—the supply of electricity! Apart from the repetition of the foregoing statement in the same paragraph, this is, we believe, with one exception, the only direct reference to electricity supply in the text of the Bill. Of all the diverse interests immediately affected by the Bill, only one has expressed approval of its aims—the Waterways Association, the champion of a forlorn hope—whose only prospect of achievement certainly lies in State ownership. Bitter opposition is being organised by the motor-vehicle interests, Manchester Ship Canal, and the Mersey Docks and Harbour Board, and there is a general fear lest the proposed Minister—Sir Eric Geddes—being a railway man, shall subordinate the interests of his other cares to those of the railways. The Bill is regarded as a long step in the direction of the nationalisation of the railways, a process which could apparently be completed by an Order in Council, and the prospect is regarded with universal alarm—except, perhaps, by the socialistically inclined. The powers conferred upon the Minister are of the most arbitrary and autocratic description, practically without limit, except in respect of municipal tramway undertakings, which cannot be acquired by compulsion. Rates, fares, &c., can be altered by the Minister at will, in spite of existing statutory provisions; money can be lent or granted to any undertaking, subject only to the consent of the Treasury.

The electrical industries are, of course, intimately affected by the Government's proposals in almost every aspect, either as manufacturers of plant for use in the working of the railways, docks, &c., or as users of transport facilities; but at the moment the paramount consideration is the question of national electricity supply: what is being done by the Government to carry out the scheme supported by the Board of Trade, and referred to so frequently by the Prime Minister? To what draft Bill did Mr. Lloyd George allude last week, when he told Mr. Smillie, with reference to the more efficient utilisation of coal, that the Cabinet had just passed the draft? To what Bill did other remarks refer which we have reported from time to time? To *this*?—If so, there is indeed but little wool to show for so confident a cry.

We believe, however, that this is not the case; the real Electricity Bill is in course of preparation, and will shortly

be introduced into Parliament. In the meantime, in the absence of even a shred of detail, and of any indication of the Government's real intentions, it is impossible to comment on the matter to any useful purpose. All that we can say is that if the electricity scheme is to be handled in this way—subjected to the control of a Department which is not yet organised, and which will be charged with immense responsibilities having little or nothing in common with electricity supply—we may bid farewell to the hopes of reform which we had cherished, and resign ourselves to the inevitable stagnation which must follow. If our fears are justified, not only the electrical industries, but the national interests, will suffer a disastrous set-back by the inclusion of electricity supply in this gigantic scheme—an undertaking which can only be tackled successfully by a Heaven-born genius, a superman, such as this century has not seen.

It is true that the railways, when electrified, will be amongst the most important consumers of electrical energy, and that they afford convenient routes for transmission lines; also that the extension of the railless trolley system along the country roads offers by far the most promising solution to the problem of transport for agricultural products and passenger traffic; and it is alleged that the Government seriously contemplates great developments in the electrification of main-line railways. But all this will take years to accomplish, and the matter is of the most pressing urgency—extensions of electricity works and new power stations are being put in hand, and the huge accumulation of arrears in electrical development must be worked off as quickly as possible. We earnestly hope, therefore, that no more time will be lost in giving definite form to the national scheme, and especially that the appointment of the Board of Electricity Commissioners, with adequate powers, will be carried through as quickly as possible.

I.E.E. Informal Meetings.

In our "Notes" to-day we give particulars of the arrangements which have been made for the first of the "informal meetings" which were recently mentioned by the President as being in course of organisation. It has always been observed that at the ordinary general meetings of the Institution the speakers are drawn mainly from the ranks of the older members of the profession, the younger men, though often invited to share in the discussions, preferring to act the part of listeners. Whether their silence be due to diffidence or to inexperience, it is unquestionably regrettable that the juniors should hang back, and, in order to remedy this failing, the Council decided to inaugurate these informal meetings, at which the junior members will be encouraged to air their views and to practise the art of debate. Their elders may, indeed, attend the meetings, but their presence is not particularly desired; the arrangements will be entrusted to a committee of juniors, who will select the papers and occupy the chair in rotation.

We understand that between the paper and the discussion, there will be a short interval for light refreshments and conversation, a novel departure which will add variety to the proceedings. From the interest and enthusiasm which have already been manifested in the scheme by those most directly concerned, there is every reason to expect that this practical effort to supply the needs of the large body of members comprised between the Student class and the full-fledged professional men will receive a hearty welcome, and will prove successful from the start.

It will be noted that with the inauguration of "informal meetings," yet another of the many proposals outlined by Mr. Wordingham in his Presidential address in 1917 takes practical shape. The list is by no means exhausted, and the most important item of all—the obtaining of a Royal Charter—appears to hang fire. But in view of the remarkable successes which he has already attained in carrying his programme into effect, we shall continue to hope that this may yet prove to be, as we said 16 months ago, "the crowning achievement" of his period of office.

The Functions of a Trade Journal.

We note with interest in our lively young contemporary *l'Electricité* the following editorial remarks: — "Several readers have expressed their astonishment at seeing described in *l'Electricité* only apparatus of foreign origin. On the other hand, others have thanked us for providing them with the heating elements—metaphorically speaking—which have enabled them to contend with the horrors of the terrible winter that we have just passed through." The Editor goes on to say that he would gladly have described French apparatus first of all, but, unfortunately, he finds it difficult to extract the necessary information from French manufacturers, whereas British and American firms have immediately placed at his disposal full particulars of their products, and have even sent him actual samples. The reluctance of the French makers to accept publicity appears to be a complaint of long standing, due to their fear of supplying information to competitors; we are glad to see that our own manufacturers are divesting themselves of this erroneous idea, against which we have often fought in the past. That it is erroneous was amply demonstrated by the success which attended the efforts of our German competitors before the war—they were always ready to impart information with lavish completeness.

But at the moment we are concerned, not so much with the attitude of manufacturers towards the media for publicity which are open to them, as with the question of the functions of such a medium—a trade journal such as our own. Should its pages be open only to home products? or should it describe also the manufactures of foreign rivals? We have often considered this question, and have no doubt as to the correct reply.

In our opinion, it is our duty to keep our readers as fully informed as possible on every development in, or associated with, electrical engineering throughout the whole world. That is the only policy which conduces most efficiently to progress in our own industries—the fact is undeniable. The dissemination of up-to-date information is one of the most important functions of a trade journal, in order that inventors and manufacturers may know what they are up against, what are the requirements in foreign markets, and in what direction the trend of progress lies. Not only is this knowledge necessary in order to develop export trade, it is equally necessary to retain control of the home markets, for what is found successful abroad will soon be introduced at home, if not by our own firms, then by their rivals. Hence, every progressive manufacturer is anxious to know what his competitors are doing, in order that he may go one better; and it is for that reason that we keep a watch upon the foreign technical Press and publish descriptions of new apparatus and installations of alien origin.

But, it may be urged, if we derive useful information from the foreign technical Press, shall we not do well to withhold such particulars from our own Press? There is the old fallacy again. Granted that there are some details of manufacture that should not be revealed—we do not wish to publish *them*; there remains an abundance of material, the publication of which will afford no assistance to the rival, while it will be of immense benefit to the maker of the goods. Again we draw attention to the practice of our enemies—not only before the war, but, in neutral countries, during the war; the keynote of their policy was Publicity. It paid them handsomely, and it will pay us still better in the times that are before us.

Publicity is the watchword of the successful manufacturer; and it is one of the principal functions of the trade journal to assist him in securing it, in the right way and in the right quarters.

ELECTRICITY SUPPLY AT BIRMINGHAM.

For some years before the war, the load supplied by the Birmingham Corporation Electric Supply Department had increased at a regular and satisfactory rate, and additional generating plant had been installed from time to time to supply the increased demand. Just prior to 1914 the equipment of the principal generating station at Summer Lane was completed by the addition of two 5,000-kw. B.T.H. turbo-alternators, and work had already been commenced upon the foundations of a proposed new generating station at Nechells, which was designed for an ultimate capacity of 100,000 kw. Immediately upon the outbreak of war, however, all further work in connection with the new generating station at Nechells was stopped at the request of the Government, which at that time could not have foreseen the phenomenal increase in the load which soon afterwards took place at Birmingham, due to the demands of factories engaged on the manufacture of all kinds of munitions of war.

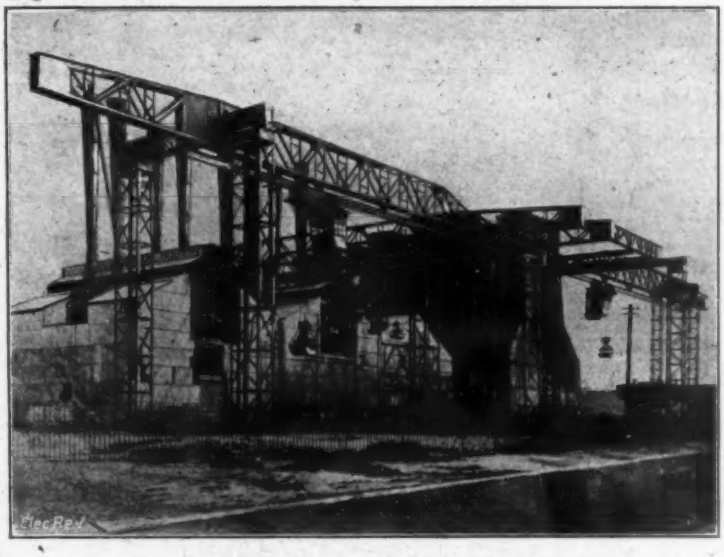


Fig. 1.—Electrically-driven Telphers at Nechells.

Faced with a rapidly-increasing load, which in the national interest had to be supplied, and without accommodation for further plant in the existing generating stations, the Electric Supply Department decided at the beginning of 1915 to proceed with all haste with the erection and equipment of a temporary generating station, which was to have a plant capacity of 10,000 kw. This temporary station was got to work in 1915 in record time (within nine months), but proved quite inadequate to meet the ever-increasing demand for power, and extensions bringing the total plant capacity of this temporary station up to 22,000 kw. were taken in hand, this being the maximum amount of plant which could be accommodated on the site chosen. These extensions were completed in 1916-17, and since that date the Birmingham Corporation has been compelled to make other temporary arrangements for supplying the further heavy increases in load due to the war.

The site chosen for the temporary generating station adjoins the site of the large permanent station, work upon which is now again being commenced, at Nechells in the north-eastern portion of the city. The site had much to recommend it; immediate use could be made of the railway sidings already constructed to serve the permanent station; it fronted on to the Birmingham and Warwick Junction Canal; ample coal storage accommodation, and an excellent ash dump, could be found on the adjacent site, whilst at a later date the feeders connected to this temporary station could be lengthened at small cost and reconnected to the new permanent station. Further, the station was near to the centre of gravity of the load to be supplied, whilst a considerable distance separated it from the nearest dwelling houses.

The land, however, was "made ground," chiefly dust-destructor clinker on sand, with a stratum of running sand some 10 ft. below the surface. As rapidity of construction and strict economy of capital expenditure were essential, it was decided to construct a solid concrete raft on the surface of the land, and to erect the buildings and machinery on this, no basement of any sort being arranged for.

The buildings themselves consist of a framework of rolled steel joists and angles, the roof and walls being formed of corrugated asbestos sheets, and the whole making a thoroughly substantial, weather-tight structure with a minimum of dead weight.

The power station as it exists to-day really consists of two distinct and separate stations adjoining one another, the first station containing 10,000 kw. of plant (the amount which was originally assumed would amply meet the war needs of Birmingham), and the second containing 12,000 kw. of plant, which was afterwards found to be urgently required, and which in turn proved insufficient to supply the whole of the additional load.

The general lay-out of the station is shown in fig. 3, p. 256.

Nos. 1 and 2 boiler houses each contain six Babcock & Wilcox marine-type, water-tube boilers, with superheaters, each boiler being fitted with mechanical chain-grate stokers, and having a normal full-load duty of 35,000 lb. of steam per hour at a pressure of 200 lb. per sq. in. gauge, superheated to a total temperature of 700° F.

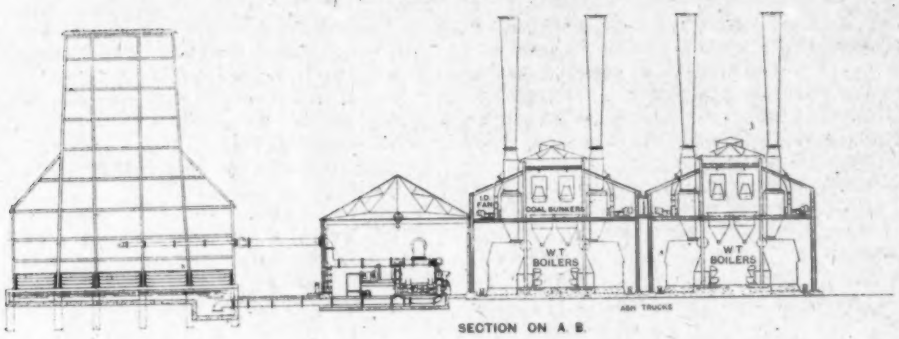
Two "Prat" chimneys with induced-draught fans, together with the necessary dampers, are provided for each set of three boilers, the normal draught at the base of the chimneys being 1·1 in. of water. No economisers are installed, but feed-water heaters connected to the exhaust of the station auxiliaries raise the temperature of the feed water to 180° F.

Overhead coal bunkers with chutes discharge into the boiler hoppers, and the bunkers in each boiler house are supplied by two electrically-driven telphers made by Messrs. Herbert Morris, Ltd., which run out over the railway track and canal to a coal store on the opposite side of the canal. These telphers are fitted with ½-ton grabs, and can each deal with 20 tons of coal per hour.

Fig. 2.— Surface Condensers.

An external view of the boiler house, showing the overhead telphers, is shown in fig. 1.

Two reciprocating and four turbine-driven feed pumps, each having a capacity of 25,000 gallons per hour, are installed at one end of the boilerhouse alongside of a Permutit



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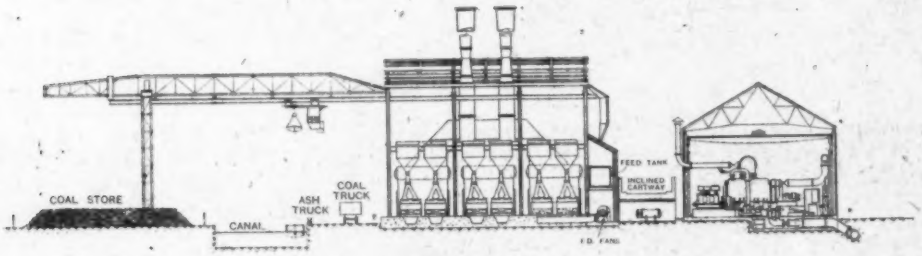

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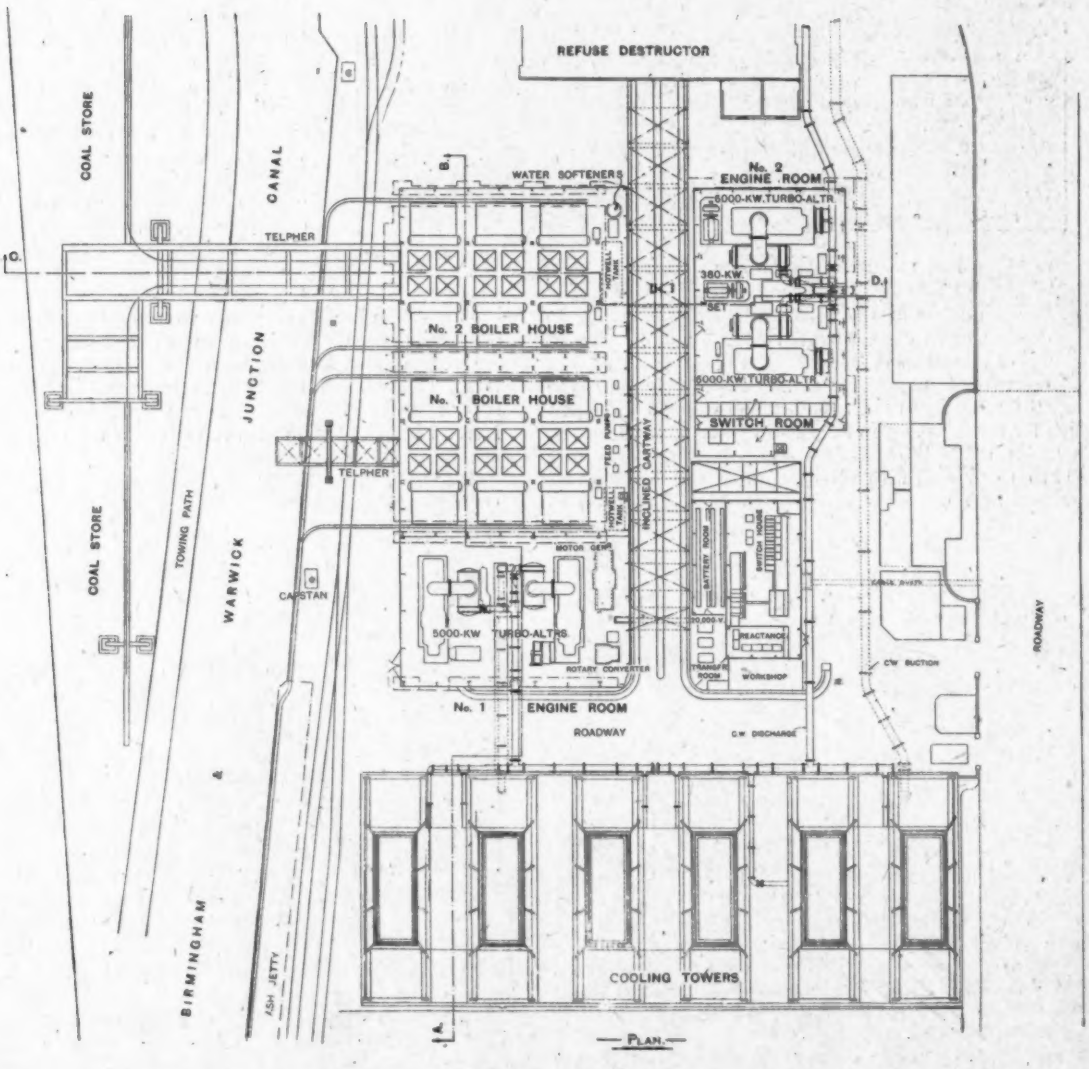


FIG. 3.—ELEVATIONS AND PLAN OF NECHELLS (TEMPORARY) POWER STATION.

water-softening plant, whilst the feed tanks are erected immediately overhead.

No. 1 engine room contains two 5,000-KW. Westinghouse turbo-alternators, and No. 2 engine room contains two 6,000-KW. B.T.H. turbo-alternators. Each of these sets runs at 1,500 R.P.M., generating three-phase current at 5,000 volts between phases, and 25 periods per second, and they are complete with surface condensers, turbine-driven circulating-water, air, and condensate pumps, together with wet air filters for the alternators.

The unusual side-by-side arrangement of the condensers and turbines, with overhead main exhaust pipe, is shown in figs. 2 and 4. This was necessitated owing to the absence of a basement.

Two Belliss-Phœnix 380-KW. D.C. steam dynamos, one 300-KW. motor-generator, and one 300-KW. rotary-converter are installed to supply the induced-draught fans, telphers, stoker motors, station lighting, &c.

Nine natural-draught wooden cooling towers, supplied by the Davenport Engineering Co., are erected above two large circulating-water reservoirs adjacent to the station. The

Each of the alternators is protected by circulating-current relays, so arranged that should a fault occur on any part of the alternator stator or its E.H.T. connections, the alternator main switch operates and disconnects it from the bus-bars, whilst, at the same time, the exciter field circuit of the alternator is broken.

The operating panel for the alternator is also fitted with a small switch for controlling the governor speeder motor, whilst in front of each of the alternator panels is mounted a Chadburn telegraph for signalling to the men in charge of the engine-room plant.

The whole of the ten trunk feeders supplied from this station are of the split-conductor type, of various sections; the cables used are six-core with the cores equally spaced, the two split conductors forming one phase not being arranged concentrically, as is usually the case.

One of the trunk feeders which runs to a distant sub-station is connected to a bank of three 1,250-K.V.A., single-phase, step-up transformers, supplied by Messrs. Ferranti, Ltd., and is run at a pressure of 20,000 volts between phases. The others are run at 5,000 volts between phases.

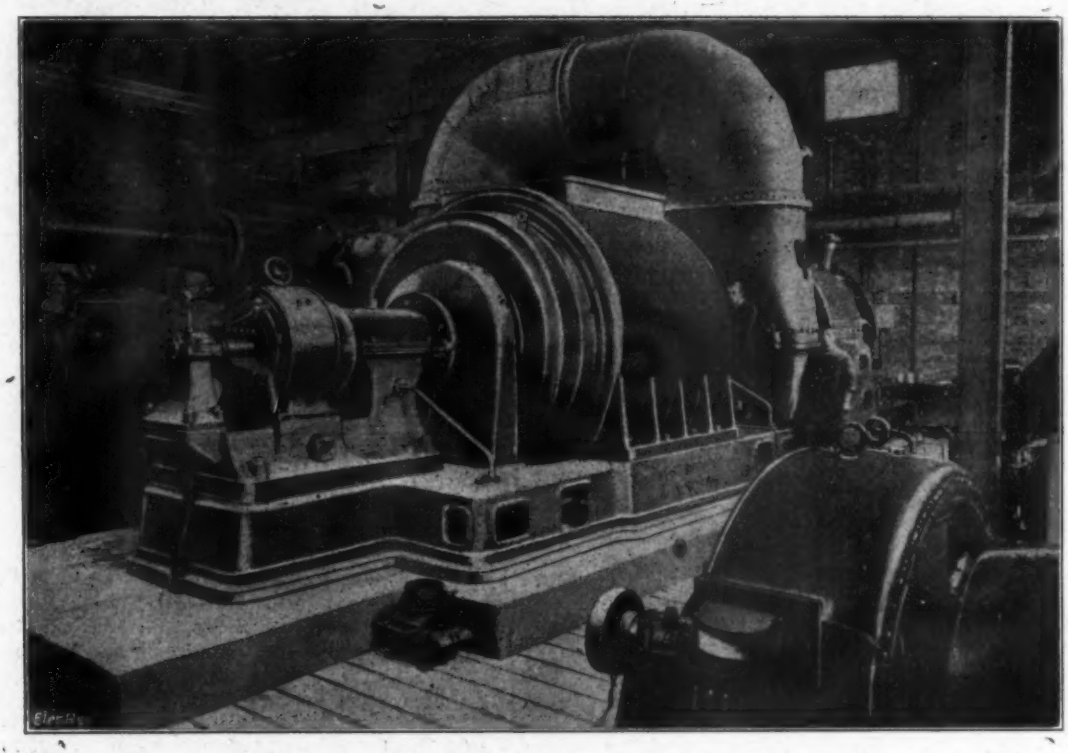


FIG. 4.—TURBO-ALTERNATOR, SHOWING ARRANGEMENT OF OVERHEAD MAIN EXHAUST PIPE.

make-up water for the towers is supplied partly from an artesian well operated by a motor-driven air compressor, partly from the town mains, and partly from purified sewage effluent from the filter beds which adjoin the site. The use of this effluent was decided upon after careful experiment. It has proved to be eminently suitable for condensing purposes, tending to prevent the formation of scale in the condenser tubes and to keep them clean. No offensive odour can be detected, and the aeration of the water in the towers effectually sterilises any germs that may be introduced.

The battery room contains a small Tudor battery of 115 cells, having a capacity of 200 ampere-hours. This is used chiefly in connection with the electrically-operated switchgear, but it also supplies a number of emergency lights in the station.

A large part of the main E.H.T. switchgear installed in Nos. 1 and 2 switch houses is electrically operated, and all the gear is controlled from No. 1 switch house, where all the A.C. and D.C. control panels are erected. The E.H.T. switchgear was supplied by the British Thomson-Houston Co., Ltd., and is enclosed in moulded stone cubicles. The oil switches are chiefly of the firm's well-known motor-operated type.

The ring mains are standard type, 5,000-volt, three-core, 0·15 sq. in. cable, and are protected by overload inverse time-limit relays.

The whole of these trunk feeders and ring mains were supplied and laid by Messrs. Callender's Cable and Construction Co., Ltd.

The planning, erecting and setting to work successfully of a station such as this, within a period of about nine months, must have meant a very great deal of hard work and anxiety for the city electrical engineer, Mr. R. A. Chattock, who not only had some specially difficult engineering problems to solve, but who was also working against time.

The Electric Supply Committee is to be congratulated upon the bold and patriotic manner in which it confronted and dealt with the grave question of supplying the great munition works in the city with all the electrical energy they required during a period of national emergency.

Our thanks are due to Mr. Chattock for placing the foregoing particulars and illustrations at our disposal. As will be seen from a paragraph in our "Lighting and Power Notes" to-day, he is at present engaged upon plans for a further extension scheme of still larger dimensions, involving the erection of a power station on an entirely new site.

THE MANAGER OF SIEMENS-SCHUCKERT ON THE SITUATION.

The Germans have found it convenient at all times to possess short memories, and the existence of the Armistice has served to accentuate this circumstance, with the additional consideration that they would like the Allies also to forget the past, particularly the past four years. This reflection has been evoked by a perusal of a report of an interview, published in a recent issue of the Paris *Matin*, between an officer in one of the Allied Armies and Herr Henrich, manager of the Siemens-Schuckert Works. The interview may be divided into three parts, namely, politics, Labour and Bolshevism, and the revival of German export trade.

Dealing with the first problem, Herr Henrich is reported to have stated that it was an error to believe that German industry had had an influence on the external policy of the Empire, and that, contrary to what was supposed abroad, there was no industrial party in Germany; industry was scarcely represented in the (late) Reichstag, and was but little occupied with politics, and industrialists knew nothing of the then impending war. It is quite true, as the manager asserts, that no industrial political party existed, at least openly, and that German manufacturers directly participated to an insignificant extent in the former Imperial Parliament; but they intend, if possible, to take a strong hand in politics in the future. The influence of the industrial interests, however, was brought to bear all the same by indirect methods—through the Central Verband Deutscher Industrieller (Central Union of German Manufacturers) and the Bund der Industrieller (Federation of Manufacturers), which are the greatest combinations of manufacturers in Germany, which have just been amalgamated for the presentation of a united front on political and economic questions, and in which the interests of the electrical industry were, and are, represented. If the industrialists, through these and other associations, never exercised any influence upon the foreign policy of the country, how is it possible otherwise to explain the sabre-rattling of some years ago—the threat of war at that time—in connection with iron-ore concessions in Morocco and the Mannesmann Brothers? A second instance takes us back still further—about 15 years ago—when the Imperial Chancellor made serious threats towards Sweden in the event of the Swedish Government placing an embargo on, or considerably reducing, the exports of the low-phosphoric iron ores of which certain of the large works in Rhenish-Westphalia were then, and are now, in great need. Had there been no indirect pressure on the part of the iron and steel industries in these two cases, no menaces would have been uttered towards Sweden, and no sabre-rattling would have taken place in regard to France and Morocco. So much, then, for the German theory, which could be further exposed from German private documents which have gained publicity during the war concerning the influence exerted by the great manufacturing and agricultural Associations on the Government in the past four years, of no interest being taken by industrialists in external politics.

We pass over the now time-worn legend that "the German nation rose to defend its frontiers," and come to the question of Bolshevism. In this connection, Herr Henrich now admits—but only now that conditions are changed—that the Brest-Litovsk treaty was a serious mistake; a treaty of violence, he said, did not reconcile the two nations; it served the purposes of Lenin. Marshal Foch, in his opinion, does not seem to have understood this historical lesson. The plan of Lenin was the coalition of the Russian and German proletariats against imperialism and capitalism of the Entente. France flattered herself, as the Germans had done, that she would escape the fire. The Germans had created a zone of neutral countries between themselves and Russia; France wished to create autonomous States on the border of Germany, but Herr Henrich remarked that neither autonomous States nor military forces circumscribed the Bolshevik danger, which must be throttled on the spot where it raged. If this danger were averted and the wages question settled, the manager was of opinion that German industry would recover. On the matter of wages, he rightly stated that this problem was arising, or would arise, in all the Allied countries. It was necessary for the German workmen and employers to come to an understanding as soon as possible; otherwise the depth of the abyss to which they were proceeding could not be measured. An effort in this direction had been already made by the formation of working communities, or joint committees of workmen and employers in equal numbers, to settle the wages question and the economic possibilities of industry. This was the first step towards an industrial Parliament which was desired, in which workmen and employers would be represented in equal numbers, and which would devote itself to social and economic questions in relation to industry. Apart from this, Herr Henrich mentioned that the workmen were preparing a European understanding; that there was needed a European understanding between employers, and that he hoped this would be established without delay.

The idea of an agreement between employers in Allied countries and those in Germany is positively astounding. It is a further confirmation of the mentality of the Germans, who still fail to understand that, except where absolutely necessary, Allied countries will neither trade with Germany nor enter into agreements for international action in regard to labour and social questions. Herr Henrich also entered upon dangerous ground when he expressed himself as an optimist in respect to any boycott of Germany. If the dangers of Bolshevism and wages questions were successfully overcome, and, "if we can find the raw materials, German industry will be able to recover in a few decades." The manager carefully overlooks, however, the intended rationing of raw materials by the Allies in so far as their resources are concerned, and unless the Germans and the Russians reach a mutual economic agreement for the utilisation of the great mineral and other resources in Russia, the optimism of Herr Henrich probably will soon change to pessimism. Concerning the loss of customers throughout the world, he stated that the Germans would recover them, because the products which the world had been unable to obtain from Germany during the war had not been bought elsewhere. In two or three respects this assertion is correct, but it is quite untrue in many lines of merchandise which have been purchased by neutral countries from Spain and the United States during the war, particularly by South American countries, before the United States became a belligerent. Herr Henrich repeats the ancient story about the perfection of German equipment and technical methods which are to enable the Germans to deliver good products at low prices, whilst the German tariff and the quality of the goods are to open the world's markets to them again.

If Herr Henrich had studied the iron and steel situation in Germany and the general course of labour movements there, it is probable that he would not have been so confident as to the future. The loss of Alsace-Lorraine and Luxemburg, and the preferential claim on a large quantity of the production of German coal which will be exercised by the Allies for quite a number of years hence, have reduced German industrially to a fourth-rate power. Iron and steel react on mechanical and electrical engineering, shipbuilding, and other industries, and not even Sweden and Spain, who themselves are determined to develop their industrial resources, could prevent Germany from a permanent loss of a very large percentage of manufacturing trade. It is only Russia which could save Germany from industrial disaster, and it should lie in the hands of the Allies to frustrate any attempt in the direction of the mutual amalgamation of these interests which, as some Germans hope, would lead to another war 30 years hence, with totally different results from those which are now on record.

RECONSTRUCTION: THE TIME FOR CLEAR THINKING AND STRAIGHT TALKING.

By FRANK J. MAURICE.

Some years ago the writer had the good fortune to be associated in some of his work with M. Flourence Guitton, the well-known French civil engineer, and learned from him of his successful introduction of the Taylor system into France, and of the excellent results obtained there in one works after another. From then to the present time the writer has accumulated information as to the extension of that system to the leading engineering and other works in the United States and in Germany, and has taken every opportunity of endeavouring to impart to others his conviction that "Scientific Management" is the keynote of the problem of industrial reconstruction in this country. This problem may be briefly stated as follows:—So to increase production and lower labour costs that labour may receive satisfying compensation—as higher wages, &c.—without prejudice to a fair interest on capital.

The formation of a society to investigate the subject was foreshadowed recently in these columns, and subsequently the Industrial Reconstruction Council took the matter up, and called a Conference on February 27th, when Major E. A. Pells, R.E. (Assistant Director, Efficiency and Costs Section, Ministry of Munitions), lectured on "Scientific Management," and in the brief time at his disposal outlined some of the principal features of the system—such as accurate time study, functional foremanship, planning room, &c. An interesting discussion followed, and the outcome of the conference was a proposition by the chairman that (1) a series of some half-a-dozen conferences on the subject should be arranged, or (2) that a separate society should be formed to deal with the matter, the first proposition being decided upon for the moment. It is very desirable that electrical manufacturers and works managers should obtain particulars of these conferences from the organising secretary (Lieut.-Col. E. Pottinger, D.S.O.) of the Industrial Reconstruction Council.

It has often been stated that the war was one of "workshops," but it is little realised that in the days when the Boche was able to throw dozens, or even hundreds, of shells into our lines to every one that we sent over, *it was the Taylor system in Germany which was giving him his output.* The Taylor system was extensively in use in Germany before the war, and in the early days of the war opportunity was still found further to extend the system for munitions production.

It is worthy of note that at the present time not a single works in this country employs this system, a few experiments in task work, with a bonus and other advanced-pay systems, being almost all there is to our credit in this connection, while the essentials of the system—accurate unit-time study, functional foremanship, standardisation of operations, planning-room, &c.—are, so far as the writer is aware, non-existent. There is still a considerable amount of prejudice, even in so-called well-managed works, against American methods, but when the statement is made, based on the evidence of those who have worked under and over the Taylor system, that production is increased thereby from 200 to 400 per cent., the claim made at the beginning of this article, that the system is the keynote of industrial reconstruction, will eventually have to be investigated by every progressive industrialist.

In the discussion following the Conference on Feb. 27th, there was exhibited a tendency to confuse the question of increasing production with the method of distributing the increasing profits accruing as between employer and employé. The two questions are entirely separate; and while there may be, and is, much difference of opinion as to how the profits should be distributed, there is no difference of opinion as to the necessity for increasing production—not merely that profits may be increased or maintained, but in order to assure to the nation a continuance of its industrial life at all.

To quote, in conclusion, from one of Dr. Taylor's books ("Shop Management," by Frederick Winslow Taylor, M.E., Sc.D.):—

"It is safe to say that no system or scheme of management should be considered which does not, in the long run, give satisfaction to both employer and employé, which does not make it apparent that their best interests are mutual, and which does not bring about such thorough and hearty co-operation that they can pull together instead of apart." And again: "What the workmen want from their employers beyond anything else is high wages, and what employers want from their workmen most of all is a low labour-cost of manufacture. These two conditions are not diametrically opposed to one another, as would appear at first glance. On the contrary, they can be made to go together in all classes of work, without exception, and, in the writer's judgment, the existence or absence of these two elements forms the best index of either good or bad management."

GREATER LONDON ELECTRICITY SUPPLY.

The agenda paper of the London County Council for March 4th contained an interesting report by the Special Committee on London Electricity Supply, setting out tables to enable comparison to be made of the present position of the electricity supply for Greater London with that obtaining before the war. Readers of the Electrical Review will recollect that the L.C.C. used to publish such statistics annually at a cost of about 1s., the last issue being for the completed returns of 1913-14, *i.e.*, in the case of the undertakings owned by companies the returns were made up to December 31st, 1913, and for the local authorities up to March 31st, 1914. The figures now published in less detail are made up for the companies to December 31st, 1917, and for the local authorities to March 31st, 1917. A few of the undertakings owned by companies outside the County of London have not provided returns, but whilst this is to be regretted, it is considered that such returns are not of sufficient importance to affect the figures as a whole, or the general conclusions to be drawn from them, whilst further delay would have been occasioned if it had been decided to hold up the available figures until every one of the undertakings had furnished the desired information. No figures are given to indicate the capital expenditure incurred to the date of the returns, and in many other respects the statistics will fail to afford the very full information which the well-known annual publication had previously provided. Whether this may eventually be issued is not indicated; the war has upset the regularity of many things, and useful as this regular issue has been, it may not be found possible immediately to resume its publication.

Statements are appended to the report showing separately for local authorities and companies a comparison between the years 1913 (or 1913-14) and 1917 (or 1916-17) under the following heads—maximum demand in kilowatts, number of units sold, generating costs per unit sold, and revenue per unit sold.

The following figures summarise the position in the two periods as regards the undertakings covered by the tables:—

		Local authorities.		Companies.		Total.
		In London.	Outside London.	In London.	Outside London.	
Max. demand	1913	67,700 kw.	41,618 kw.	117,288 kw.	4,509 kw.	231,115 kw.
	1917	82,776 kw.	41,628 kw.	141,294 kw.	7,884 kw.	273,782 kw.
Increase per cent.		22·2	0	21·1	63·8	18·4
Units sold	1913	123,427,958	88,339,491	195,143,252	6,489,827	413,799,928
	1917	180,909,084	100,090,508	254,850,894	16,689,412	551,469,898
Increase per cent.		46·1	13·2	30·6	157·3	33·5
Load factor per cent.	1913	20·8	24·2	20	17·3	21
	1917	25	27·4	20·5	25·8	23·2
Increase per cent.		4·2	3·2	0·5	8·5	2·2
Generating costs	1913	£293,602	£231,130	£510,862	£31,579	£1,067,223
	1917	584,157	394,658	953,145	83,158	2,014,118
Per unit sold	1913	·57d.	·66d.	·63d.	1·17d.	·63d.
	1917	·77d.	1·01d.	·90d.	1·19d.	·89d.
Increase per cent.		35·1	53	42·8	1·7	41·2
Revenue	1913	£946,075	£579,961	£1,943,653	£124,169	£3,593,858
	1917	1,324,264	671,704	2,462,476	221,220	4,579,664
Per unit sold	1913	1·83d.	1·66d.	2·39d.	4·59d.	2·11d.
	1917	1·69d.	1·72d.	2·32d.	3·18d.	2·01d.
Increase per cent.		−11·5	3·6	−2·9	−31·7	−5

It will come as a surprise to our readers to see that the bottom right-hand figure actually proves a 5 per cent. reduction in the revenue per unit sold for 1917 as compared with 1913, although during the same period the generating costs had gone up 41.2 per cent.—the comparative figures when published for 1918 may not be so favourable to the consumers, but the result now shown is highly creditable to the engineering staffs of the London undertakings; the load having gone up by 33.5 per cent. is a significant factor; on the other hand, the load factor is seen to have grown only by 2.2 per cent.

The most noticeable reduction in price is on the totals of the companies outside the county boundaries, viz., 21.7 per cent., although the excellent figures for the local authorities in London cannot be too highly praised, starting, as they

did, with a very much lower figure in 1913, and effecting the economy on a total revenue of greater magnitude than the companies outside London.

Turning to the details of the figures for the local authorities in London, the most conspicuous success has been achieved by Woolwich, whose maximum demand has increased by 207 per cent., and the units sold by 553 per cent., whilst generating costs and revenue per unit sold have been reduced by 22 per cent. and 44 per cent. respectively; to turn out over 26 million units with a load factor of nearly 45 per cent. in 1917, against 4 million units in 1913, is indicative of real hard work and a very strenuous activity. The output is only surpassed by one other borough, viz., Stepney, whose total is given as 27 million units. Woolwich alone has succeeded in reducing its generating costs, and Mr. Keats, the borough electrical engineer, and the members of his staff, are to be heartily congratulated. Battersea and Fulham have each increased the number of units sold by over 100 per cent. (as the two boroughs are linked up by trunk mains it is not clear whether some part of the energy may have been recorded twice, first being sold in bulk, and subsequently by the other authority to the consumers); in the column of generating costs Bermondsey shows an increase of 116.7 per cent., whilst under the heading of revenue per unit sold Woolwich has the only 1917 record under 1d., with a figure of 0.91d., Poplar and Stepney following with 1.06d. and 1.16d. respectively.

Dealing with the London companies on similar lines, the return shows that the South Metropolitan Co. has an increased maximum demand of 108.5 per cent., an increased sale of 186.6 per cent., an increased generating cost per unit sold of 38.8 per cent., and a diminished revenue per unit of 32.9 per cent.; the Metropolitan Electric Supply Co. has an increased output of 57 per cent.; the only company showing a lower generating cost is the Westminster, the 1913 figure being 1.3d., against 1.12d. for 1917, a decrease of 13.8 per cent.; this, however, is no doubt partly due to the purchase in bulk from the Central Co.

Amongst the returns from other areas, the largest by far is West Ham, but the units sold have increased in the three years under discussion by only 2.6 per cent. to a total of 35,298,301, whilst the maximum demand has actually diminished by 3.3 per cent., and generating costs have gone up by 78.6 per cent., although the actual figure of 0.75d. compares very favourably with the pick of the 1917 figures.

Comparing one set of figures with another in the summary given above, it will be seen that the London companies sell the greatest number of units, but that the best record for cost of generation is secured by the local authorities, the companies' costs being 10½ per cent. higher in 1913 and 16.9 per cent. higher in 1917 than the local authorities' costs; it is not easy to understand how or why this should be. It is easy to determine that one individual undertaking of either group may have especially favourable or unfavourable conditions which affect its record, but such conditions would naturally tend to average out, whilst that group having the greater output might be expected to have an advantage over the other group.

The report is signed by Mr. G. H. Hume as chairman of the Special Committee on London Electricity Supply; that committee was appointed, we believe, about 1912, and accumulated, with great care, a mass of evidence before producing its Bill of 1914, which it will be remembered failed to obtain the necessary majority of the whole Council when brought up for consideration under the Public Funds Act, and therefore the Bill never came into the Parliamentary arena, where its merits might have been thoroughly sifted. Mr. Hume has since sat on the Board of Trade Electric Supply Committee, and in view of the present Government activity in the matter it will not be surprising if the County Council Committee ceases to do more than hold a watching brief for the future; in this capacity it may still do most useful work in centralising, without controlling, the too numerous interests of Greater London's electricity supply.

Had the electricity supply of Greater London been taken over by a Government department during the war, would the average revenue per unit from the consumers have shown a 5 per cent. reduction? There is reason to doubt it; to quote a few of the well-known items monopolised by the Government: postal charges, telegrams, telephone service, railway rates—all have gone up, and no question of equity as between buyer and seller can be effectually raised. How soon it may be possible to restore the generating costs of 1913 we hesitate to guess, although we do not by any means hesitate to hope. Notwithstanding all the unrest in the labour world, so evident at the present time, science and skill, intelligence and industry will again be employed to the fullest advantage by the engineers in charge of the undertakings supplying Greater London with electricity for all purposes, whose 1917 records are both interesting and creditable.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Large Electrically-Welded Pipe.

In view of the interest that is being taken in electric welding at the present time, the illustration which we reproduce below (fig. 1) of a large electrically-welded pipe, forming part of the pipework contract carried out for the new Rotherham Corporation power station, will be of interest. The whole of the circulating-water system at the station referred to was manufactured, supplied, and erected by Messrs.

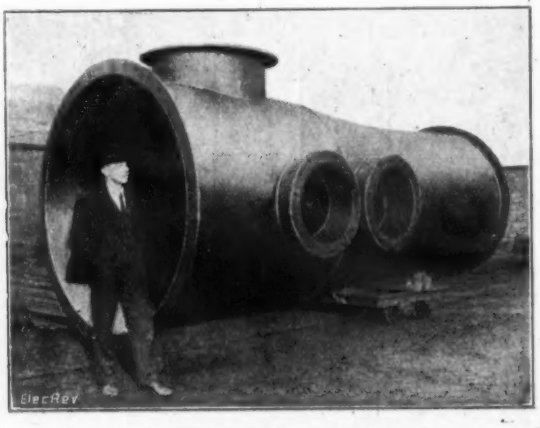


Fig. 1.—An Electrically-welded Bus Pipe.

Aiton & Co., Ltd., of Derby. The pumps deliver through branch pipes to a main bus pipe, 78-in. bore, tapering down to 39 in., each condenser being supplied through branch pipes, 25-in. bore, from this bus pipe. The bus and part of the delivery pipes are flanged, and constructed of mild steel plates 5/16 in. in thickness. The bus pipe is, the makers believe, the largest ever constructed in this country on this system, the flanges, branches, longitudinal, and circumferential seams all being electrically welded. The whole of the bus pipe is supported from the under side of the engine-room floor. The section shown in our illustration is one half of the whole bus pipe.

Electrode Annealing.

Amorphous carbon electrodes have for a considerable time past been obtainable in Great Britain, though their manufacture has presented some few difficulties. Some little time ago the Davis Furnace Co., of Luton, was commissioned to design a gas-fired type of oven furnace which would overcome the trouble which had been experienced in satisfactorily annealing this material. The work calls for extremely uniform temperatures throughout the heating chamber, varying from 450 to 600 deg. C., which have to be maintained for long periods with great accuracy. The best results are obtainable if the electrodes are annealed in a vertical position, so it will be seen that a furnace capable of taking a charge of say 20-in. diameter carbons requires to be of very large dimensions. The particular furnace referred to is installed in a large steel works in the Midlands, whose output of electric steel exceeds 30,000 tons per annum. The heating chamber measures 9 ft. wide by 6 ft. back to front by 9 ft. high, and is designed to accommodate six electrodes at a time of sizes up to 22 in. diameter. The furnace is constructed of a special quality refractory material, with walls 9 in. thick. A supplementary access door, 2 ft. by 2 ft., is fitted at one end for the purpose of removing electrodes which may be accidentally broken during insertion, and it also provides a convenient means of effecting slight repairs. The top of the furnace, or cover-plate, is in two parts, of box section, and, in addition to providing for the insertion and support of the electrodes, it serves as a pre-heater for the air supply taken by the burners. The burners, of which there are six in all, three on each side, are of the makers' so-called "fan-air" type, for consuming gas at town pressure under a slight supplementary air pressure of about 6 in. water column. If necessary, this type of furnace can be arranged with the heating chamber divided by a central partition wall, which enables two kinds of electrodes requiring different annealing temperatures to be treated at the same time.

LEGAL.

Gilling v. Epsom Urban District Council.

This action came before Mr. Justice Bray in the King's Bench Division on February 25th, upon a special case referred to him upon points of law as to the liability of the Council to pay Mr. A. C. Gilling, its electrical engineer, salary during his absence in the Army, in accordance with a resolution passed at a meeting of the Council subsequent to his enlistment.

Mr. Kerr appeared for the plaintiff, and the defendant Council was represented by Mr. Courthope Monroe, K.C.

From the statement of plaintiff's counsel it appeared that he claimed (1) a declaration that he was entitled to recover from the defendants half salary as chief electrical engineer to the defendant Council as from February, 1916, (2) an account, (3) payment of the amount found to be due on taking the account, and (4) alternatively, damages for breach of contract. From the position of second assistant engineer plaintiff was in October, 1908, appointed chief assistant, and in July, 1909, he became chief engineer. His remuneration rose from £200 a year to £250 by annual increases of £10. He continued to perform his duties till September 3rd, 1914, when he joined His Majesty's Forces. On September 8th, 1914, the defendant Council passed the following resolution:

> In the case of men and officers in the ordinary and continued service of the Council on and since July 4th, 1914, the Council provide for payment to them or their representatives during their absence from duty of their full regular pay, less a deduction on account of their Army or Navy pay (exclusive of allowances), with a minimum in all cases of not less than half of such full regular civil pay, and that their situations be kept open.

From September 8th, 1914, to September 3rd, 1915, the Council paid the plaintiff his full salary of £250 per annum, less 1s. a day, the amount of his Army pay. On September 3rd, 1915, plaintiff accepted a commission, and from February, 1916, his Army pay exceeded his salary. On February 8th, 1916, the Council passed a resolution rescinding their former resolution relating to the war-pay of employés, and directing that with their Army pay and allowances their income should be made up to the amount of their employment pay. The payments to the plaintiff were allowed by the auditors of the Local Government Board, and the questions now submitted for the decision of the Court were (1) whether the resolution of September 8th, 1914, amounted to a contract with the plaintiff which was binding upon the defendant Council, (2) whether the resolution was binding upon the Council under the provisions of the Local Government Board (Emergency Powers) Act of 1916.

Counsel, continuing, said that before he joined the Forces plaintiff expressed his intention of volunteering to the Chairman of the Council, and he (the Chairman) replied: "All right, you go ahead," or something to that effect. His first point was that outside the Statute there was a contract which was binding upon the Council. The plaintiff volunteered, and the Council passed a resolution that it would pay the volunteers. Immediately after he had volunteered the resolution was passed, and he was treated as a person to whom the resolution applied. He got his half-pay for five months, and the auditor of the Local Government Board allowed it. Counsel contended that the resolution was binding upon the defendants, and could not be rescinded so far as plaintiff was concerned without his consent.

His Lordship: If he is released from his duties, where is the obligation upon the authority to pay?

Mr. Kerr said that plaintiff was released from business for a certain purpose, and his engagement as an engineer was not terminated. His place was kept open, and he was told that in the meantime he would receive certain payment. They said, "We don't regard you as having terminated your engagement, but as having leave of absence." Assuming that there was a consent that he should go, it was an agreement that he should go, and having agreed to pay half his wages, they could not now turn round and say "this is not binding upon us." If there was not a binding contract, the resolution was binding under the Statute.

His Lordship said he would like to help the plaintiff if he could, but he was afraid he could not.

Mr. Courthope Monroe, K.C., for the Urban District Council, said he did not want it to be supposed that the Council had acted harshly in this matter; but it wanted to have the point decided. When plaintiff went out to the war, the position of the local authorities was very doubtful, and they were not put in a legal position until the passing of the Act of 1916. Owing to the action taken by different local authorities it became necessary to put the matter on a legal footing. In the first place, they said they would only consider the pay and not the allowances in calculating the amount they would give, but they also had to take into account the allowances. The Act of 1916 said that so far as the money had already been paid it should be binding on the local authorities. That left the non-inclusion of the Army allowances in the air, and they would still be liable to be surcharged unless the Local Government Board sanctioned the payment. The payments went on until May 17th, and the whole benefits which the Corporation could confer had been received by the plaintiff. He never had any contract with the Council, because it could not contract until the Act was passed.

His Lordship said that when there was no consideration the contract would not be binding.

Mr. Kerr said that the mere fact the formal resolution of the Council was not passed until after the plaintiff had taken steps to join the Army should not bar him from the privilege. He contended that in joining the Forces plaintiff had the consent of the defendants, and that the promise defendants then made was binding.

His Lordship, in giving judgment, said that the resolution of the Council did not amount to a contract which was binding upon the defendants so far as the plaintiff was concerned. If the resolution had been passed before the plaintiff joined the Army it might be construed into an inducement to him to join, and that would amount to a contract, but the resolution was not passed until afterwards. The resolution clearly did not make a contract. It was said that he left with defendants' consent, but that did not bind the Council to go on paying his full wages. There would therefore be judgment for the defendants, with costs.

THE SALARIES OF ELECTRICAL STAFFS AT ELECTRICITY WORKS.

The application of the Electrical Power Engineers' Association for certain wages and salaries increases to members of the Association was submitted to an Arbitrator, Mr. W. H. Stoker, K.C., appointed by the Minister of Labour under the Conciliation Act, 1896, and on February 27th, 1919, an award was made covering the demands of the Association (see Elec. Rev., February 21st, 1919, p. 224).

The allowance of £90 per annum is to be resognised as a war advance, and all war advances, bonuses, or allowances previously granted are to merge therein, and also in the 20 per cent. increase.

In the case of any employé concerned having first entered the service of any of the undertakings concerned subsequently to July 31st, 1914, and prior to March 31st, 1918, the 20 per cent. is to be paid on the salary or wages paid to him on so entering, minus any proportion as may represent war wages, bonuses, or allowances, but plus any grade, merit, or scale incremental advances between the date of his so entering and March 31st, 1918. Any difficulty arising as to settling this proportion shall be determined by reference to such similar advances as may have been given to other similar employés of the same undertaking between July 31st, 1914, and the date of his so entering, or in default of such examples, by reference to other employés of the same undertaking enjoying wages or salaries comparable with those of the employé concerned. In the event of any difficulty in the settlement of the question on this basis, the matter is to be determined by consultation between the Association and the Federation or Associations to which the undertaking belongs, or if the undertaking does not belong to such Federation or Associations, with the undertaking itself. Failing settlement in this way, the matter is to be reported to the Minister of Labour. The case of employés serving more than one undertaking in the course of the period above mentioned to be dealt with on the same principle or basis as far as applicable.

In the case of grade, merit, or scale incremental advances granted or accruing subsequently to March 31st, 1918, and prior to February 27th, 1919, the 20 per cent. awarded is to apply to, and include also, such increases as from February 27th, 1919, as being part of the wages or salaries on which such 20 per cent. is given.

In the case of any employé concerned first entering the service of any of the undertakings concerned subsequently to March 31st, 1918, the 20 per cent. is to be given on the salary or wages paid him on entering, minus such proportion thereof as represents war wages, bonuses, or allowances, the amount of the same to be determined in the manner mentioned above, plus as from the date thereof any merit, grade, or scale incremental advances given subsequently to his so entering, and prior to February 27th, 1919.

Any employé who has left the employment of an undertaking before the date of the award, but during the period covered by it, is to be dealt with on the principle of his being entitled *pro tanto* to the advances given by the award for the period during which employé was employed.

In the case of composite advances given subsequently to July 31st, 1914, the proportion of such advance given on account of the increased cost of living and attributable solely thereto, shall be determined, as far as possible, in a manner similar to that set out above. Failing settlement the difficulty shall be reported to the Ministry of Labour.

The award shall not reduce the earnings of any of the employés concerned, nor prejudice their position in the case of any undertaking having agreed to pay the advances from an earlier date than March 31st, 1918.

Undertakings which previously to the award had agreed to the terms of the claim are included in the award by virtue of their agreement. In the case of any such undertaking as regards which the Association may have accepted or agreed on a different date for the commencement of the advances given, such acceptance or agreement is to apply, notwithstanding anything contained in this award.

The award, which is signed by Mr. W. H. Stoker, K.C., is dated February 27th, 1919.

BUSINESS NOTES.

Private Arrangements.—Dunn, Davies & Whitner, Ltd., Electrical Engineers, 92, Cannon Street, London, E.C., and Martell Road, Dulwich, S.E.—A meeting of the creditors of the above was held on February 24th, at Winchester House, E.C. Mr. E. H. Hawkins (of Messrs. Poppleton, Appleby & Hawkins) presided. The Liquidator (Mr. S. R. Worley) stated that he had also been appointed to act as Receiver for the debenture holders. The company was formed last August to take over an existing business as from June 1st, 1918. The business consisted of the manufacturing of zinc pots, and the company proceeded to manufacture batteries for electric torches. The company took over assets valued at £12,174, and undertook to discharge liabilities amounting to £954, or a surplus of assets over liabilities of £11,220. The assets taken over were as follows:—Stock £1,720, machinery £4,080, tools and implements £600, property £1,300 (subject to a mortgage), furniture £700, goodwill £3,504, book debts £225, and cash in hand £44. The vendors received fully paid-up shares for the assets they transferred to the company, while shares for £500 were subscribed for in cash. The company obtained a process for the manufacture of a particular battery, but trouble was experienced in manufacturing it. A contract was obtained for the delivery of 850,000 batteries, but the first lot tendered were rejected on account of a technical fault, and the second consignment shared a similar fate. The third consignment was accepted, but then the war came to an end, and all deliveries had to cease, and the company found itself landed with a quantity of stock. From the outset the company had been financed by the Bank, who, as security, took a debenture over the assets. Most of the money found by the bank had been lost, and it was estimated that there had been a loss on the trading of between £4,000 and £5,000. Possibly the loss exceeded £5,000, as it appeared that certain debts had been over-valued. Had the war gone on the company might have recovered itself. Originally a debenture was issued to the bank for £3,000, and any further advances which might have been made, but on January 19th a fresh debenture for £6,000 was issued to the bank. Mr. Worley added that so far as he was concerned as liquidator, there was very little to liquidate. The net assets were £4,627. It was difficult to say what the plant and machinery would realise. The amount due to the bank was £7,117, and the assets were not sufficient to meet the claims of the bank by £2,489. The claims of the unsecured creditors were £1,999, to which had to be added the unsecured portion of the bank's claim of £2,489, or a total of £4,488 unsecured, to meet which there were no assets available. In addition to the liabilities mentioned, Messrs. Dunn & Davies had advanced the company considerably over £5,000, on account of which no claim was being made. The directors of the concern never drew anything from the company.

The Chairman said the only possibility of the unsecured creditors receiving any return was if the debentures were invalid, or if the business could be sold as a going concern.

A creditor said that he had heard that two offers were being made for the business, and the liquidator said that so far no definite offer had been made to him. When he accepted the position of liquidator he was in hopes of being able to carry through a scheme of reconstruction.

The Chairman suggested that an informal committee of the principal creditors should be elected to assist the liquidator in the winding up of the company, and to consider any offers which might be made for the business. This course was unanimously approved of, and a committee of five of the principal creditors was elected. The voluntary liquidation of the company will therefore be continued. The principal creditors are:—

W. Canning & Co. ...	£580	J. Custin & Sons	£180
Keith & Blackman ...	334	South Suburban Gas Co.	140
Barnard & Sons	218	Vincent & Sons	98
F. Smith	92	Ilford Dry Battery Co.	88
Hill & Co.	61		

The Electrical Trade of Brazil.—This is the title of a pamphlet issued by the British Electrical and Allied Manufacturers' Association (Inc.), 36, Kingsway, W.C.2. It is a report by Mr. John M. Glen, branch manager in Rio de Janeiro of Messrs. Mather & Platt, Ltd., who have permitted its publication. The report was prepared more particularly for the information of electrical manufacturers who desire to extend their trade with Brazil, but, as is pointed out in the preface, some of the suggestions contained in it have a much wider application among firms having overseas connections with other countries. The general conditions of Brazil and its great hydro-electric, and therefore general electrical, possibilities are first described. Mr. Glen says that responsible directors of British firms should visit such countries and study the local conditions for themselves. They would then understand that electrical business abroad is a thing entirely different from that at home. This means that men must be trained and sent out who are willing to follow a newer policy. The author passes a criticism on the electrical trade of Great Britain for manufacturing articles and training men as if the home market were the only one. "To attempt to impose men, materials, rules, and regulations, based on home conditions on a country where the necessities and conveniences are entirely different, is, in the case of Brazil, but to court trade defeat." Mr. Glen says that his report is not intended to be read as an armchair pamphlet, as it is an attempt to quicken manufacturers into the realisation of what the conditions in Brazil actually are. It should lead them to see that they must establish themselves there with their own engineers. In a section relating to electrical installations, type of current, voltage, frequency, and rules and regulations are reviewed; and other sections cover briefly such matters as water-power installations, railway electrification, electric motors, switchgear, fuses, wires and cables, lamps, electric light fittings, &c. There is also advice concerning advertising, catalogues, and propaganda, also methods of importing and retailing. The report is undoubtedly a very valuable document prepared by a man who is well qualified to write on the subject.

A German Profit-Sharing Proposal.—Herr Fritz Dunker, a Berlin engineer, contributes to the *D.A.Z.* (January 27th) an article advocating a division of profits between employers and workers. The following example will give an idea of the gist of his proposals:—

If a business which pays Mk.200,000 annually in wages and salaries makes a net profit of Mk.100,000, after deducting 4 per cent. interest on capital—the average annual wage of an employé working eight hours a day being Mk.2,400—and then distributes 50 per cent. of this net profit among the wage and salary earners, their average annual income is increased by 25 per cent. *i.e.*, up to Mk.3,000. The remaining 50 per cent. of the profit is to be divided, one half to go to the employer and the other half, viz., Mk.25,000, to be applied in the amortisation of the business. In a business with a capital of Mk.500,000 in 20 years at latest it would be completely socialised, and the national wealth increased by Mk.500,000 on the value of the business.

The Situation of the A.E.G. and the Bergmann Co.—The following are copies of the replies forwarded by the A.E.G. and the Bergmann Electricity Works Co. to questions in relation to the present condition of these undertakings:—

The A.E.G. stated that as the company were not exclusively engaged on Army contracts during the war, but continued the output of peace manufactures as far as circumstances permitted, the transformation from war to peace work was proceeding without serious difficulties. The workmen who had returned from the Front had been reinstated, and as those men who were engaged during the war were being discharged only gradually, the wages bill had very considerably increased as compared with the conditions before the war, especially as the workmen had put forward immeasurable demands since the revolution took place. It was impossible for present conditions to be maintained permanently. The export business, which had been almost entirely destroyed in consequence of the blockade, could not be resumed during the armistice so long as the stoppage of shipping traffic occasioned by England also continued in the Baltic. War orders were cancelled on the conclusion of the armistice, although certain orders were being completed as emergency work at the cost of production. There was no possibility of competing with other countries working under normal conditions under the existing circumstances of wages and working.

The Bergmann Electricity Works Co. reported that the transition from Army to peace manufactures had been completed. In Berlin the extensions carried out for the execution of war orders were only of small extent; but the more considerable extensions at Rosenthal, especially the storage rooms, were partly utilisable for peace purposes. The production of shells and fuses had been discontinued. It was of advantage that the company had been able to continue a large part of peace products during the war, both in the machine and turbine works, and in installation materials. The cable factory was in normal operation, but instead of Army cables, lighting cables, which had to be neglected during hostilities, were being produced. The lamp and meter factories were in normal working, and the automobile factory, which had chiefly turned out heavy vehicles, still had work on hand for months in advance. The principal question was to replace the stocks which had been cleared, although great caution was necessary owing to the uncertainty respecting the future situation of prices. Concerning the supply of raw materials, the company stated that no great difficulties were expected in regard to metals, as the substitutes of which experience had now been gained were still being used, whilst the existing stocks of copper were being spread over a longer period, as a result of the working time of five hours per day and the reduced efficiency of the workmen. Orders for home and foreign account were on hand in sufficient numbers, but it was not possible to manufacture enough owing to the impossibility of utilising the plant during strikes, scarcity of coal and of electrical energy, and the disinclination of the men to work. The five-hours' day is merely due to the shortage of coal supplies.

New Industry in Spain.—Our Spanish correspondent says that the "Sociedad Anonima Petrol" is now installing in Fuentetoba (Soria) a factory for the distillation of petroleum, benzine, gasoline, and lubricants from bituminous slates. An excellent coke residue is obtained, suitable for the fabrication of arc-lamp carbons, carbon brushes, diaphragms for gramophones, &c.

Industrial Unrest and Greater Production.—Referring to the present industrial unrest, Mr. James F. Hope, M.P. (Financial Secretary to the Ministry of Munitions), said that the miners' dispute was perhaps only a symptom of a good deal of general unrest that they knew existed about the country, and it was here, he believed, that the people would support the Government in a system of evolution, and not revolution. Whatever form a lasting settlement took it should be borne in mind that there must be as large a production as possible. They could not pay for the war out of banks, but they must be making more money all the time. They could not get all the cost of the war out of Germany. Therefore there must be production and proper reward for production. The greater the production and the greater the money that was made, the greater ought to be the reward, not only of the shareholders, but of the workers. If they could get employers to take the men more into their confidence, and the men to realise that it was to their interest to produce as much as possible and get their rewards for production at the same time, he thought they would get a lasting settlement.—*Sheffield Independent.*

Working Hours and Output.—Speaking at the annual meeting of Mather & Platt, Ltd., Mr. John Platt said that the unrest at present prevailing was much to be regretted, arising as it did from a legitimate desire for shorter working hours. This company had worked the eight-hour one-break day for over 25 years. Sir William Mather introduced the system in 1893, when it was given twelve months' trial. The result was acclaimed by the workers and the management as being so satisfactory that the new hours were definitely established, and had been worked ever since. "I venture to think that if other firms in engineering and other industries had realised the value of shorter hours earlier there would have been less trouble at the present time. The reduction of hours below 47 or 48 per week is also economically possible, provided the workers will welcome the introduction of more machinery and mechanical devices which will increase production, and at the same time do away with many monotonous processes now performed by hand. We must all realise that this country has to face keen outside competition, and unless production is not only maintained, but increased, we shall not be able to hold our own in the world's markets, upon which we, as an island kingdom, must necessarily depend. This year will be a difficult one, but with good feeling and common sense from all parties we should be on the threshold of greater prosperity and happier conditions for all concerned."

Catalogues and Lists.—Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—16-page booklet entitled "Electric Lighting and Heating for Ships," giving illustrations of various designs of indication signs, electric light fixtures, "Plexaim" hot bar fires for cabins, convector type heaters for saloons, electric toasters, Simplex punkahs, bulkhead, deck and other lighting fittings. Prices are quoted. Firms in the trade can have copies of the list on application.

The Key Engineering Co., Ltd., of 4, Queen Victoria Street, E.C. 4, have prepared their usual vest pocket celluloid calendar for 1919.

Export Restrictions Removed.—The *London Gazette* for February 28th, contains a further list of export restrictions which have been removed.

Siemens & Halske During the War.—A festival to welcome home the officials and workmen who had returned from the front, was organised by the Siemens & Halske Co. in Siemenstadt, Berlin, on February 13th. After mentioning that 2,600 had fallen out of the total of 46,000 workmen who had been called up for active service, Herr von Siemens referred to the activity of the Siemens undertakings during hostilities. There were, he stated, only 20 wireless stations available on the outbreak of the war, whereas several thousand installations of all sizes existed on the conclusion of the armistice. The Siemens high-speed telegraph connected together all the battle zones, and the equipment provided by the firm was also used in the naval battle in the Skager Rack. The largest aeroplanes were made by the firm. The sum of 34,000,000 marks had been paid on behalf of the workmen at the front, and a total of 70,000,000 marks had been voluntarily paid by the firm during the war. The speaker concluded by remarking that the firm regarded the future with confidence, based upon their cautious financial policy.

Liquidations and Dissolutions.—Standard Cable Manufacturing Co., Ltd., London.—Last day for proofs for dividend, March 18th. Mr. H. de V. Brougham, liquidator, 33, Carey Street, W.C.

Balcke & Co., Ltd., London.—Last day for receipt of proofs for dividend, March 18th. Mr. H. de V. Brougham liquidator, 33, Carey Street, W.C.

British Engineering Standards, Ltd.—A meeting of members will be held at 28, Victoria Street, Westminster, S.W., on March 31st, to hear an account of the winding up from the liquidator, Mr. C. Dresser.

Norman Dickson, Pringle & Co., commercial engineers, 25, Victoria Street, London, S.W.—Messrs. N. Dickson, W. G. Pringle and A. Pringle have dissolved partnership.

Small Tools Order Suspended.—The Ministry of Munitions has suspended the operations of the Small Tools Order, 1918, as from February 28th.

Machine Tool Association.—The report of the Machine Tool and Engineering Association, Ltd., for 1918, states that there are now 189 members. The assets amount to £2,780. The expenditure for the year was £1,135. The question of reorganising the Association has been seriously considered, and the proposals of the Board were to come before the annual meeting on Wednesday.

Steel Prices.—The Minister of Munitions gives notice of the following increases in the maximum prices of steel for home sales, as from March 1st, 1919. The prices are in each case net f.o.t. makers' works :—

Mild steel billets, blooms, slabs,
Sheet and tinplate bars, ordinary quality, £13 5s. per ton.

Small angles, tees and flats,
Extra List E (re-rollers only), £17 5s. per ton.

Small rounds, squares and hexagons,
Extra List G (re-rollers only), £17 5s. per ton.

The steel makers' price for small angles, rounds, &c., remains unchanged at £16 10s. per ton.

Auction Sale.—Messrs. Percy Huddleston & Co. will sell by auction, on March 13th, at Hammersmith, a large quantity of electrical apparatus consisting of motors, fans, cable, telephones, bells, &c. For full particulars see advertisement pages to-day.

Philips Glow Lamp Works.—The financial statement of Philips Glow Lamp Co. shows net profits of 3,020,000 florins for 1918, as compared with 2,680,000 florins in the previous year. It is proposed to pay 15 per cent. on the preference shares; and 51 per cent. on the ordinary shares, as compared with 41 per cent. The directors have purchased four steamers for the transport of the company's manufactures, and a large portion of this expenditure is said to have been already written off the books.

Book Notices.—We have received a copy of No. 2 of *Unity*, the new monthly organ issued by the National Alliance of Employers and Employed. The issue before us (March) contains many short articles on industrial and social subjects by Mr. Whitley, M.P., Mr. Adamson, M.P., Mr. Brace, M.P., Lord Leverhulme, Mr. Dudley Docker, Dr. Saleeby, and others.

Lektrik Lighting Connections. Sixth Edition. London: Messrs. A. P. Lundberg & Sons and S. Rentell & Co., Ltd. Price 9d. net.—No fewer than 55,000 copies of this useful little book have been issued; the present edition is enlarged and improved, and now contains over 240 illustrations. A chapter on improved tumbler-switch controls and modern systems of wiring has been added. A list of 177 holders of advanced and 307 of intermediate certificates is given, but the names of holders of preliminary-grade certificates, numbering 827, are too numerous for inclusion. Messrs. Lundberg pay a feeling tribute of appreciation to the memory of the late Mr. W. Perren Maycock, who collaborated with them most efficiently for seven years as examiner. Arrangements will be made to carry on the examinations.

Trade Announcements.—Mr. C. D. Flint, who was for many years advertising manager for the Ediswan Electric Co., Ltd., has started business as C. D. Flint, Ltd., advertising and printing contractors, at 190, Fleet Street, E.C. 4. Mr. Flint and his brother, Mr. R. K. Flint, are directors. The firm have printing works at Wimbledon, and will use the directors' experience of engineering advertising with the object of brightening and improving such advertising. They will make a speciality also of both the compilation and the production of trade catalogues.

Messrs. Film Booking Offices, Ltd., 22, Soho Square, W. 1, have now opened a wholesale "machinery department" for the supply of cinematograph, electrical, mechanical, and engineering apparatus and accessories. Catalogues are invited.

Messrs. S. Evans & Sons, electrical engineers, of The White House, St. Mark's Road, Maidenhead, announce that Messrs. S. H. and F. W. Evans having been released from the Forces, the business will be carried on as formerly.

Mr. J. R. Collen, late foreman to W. R. Reynolds, has been demobilised from H.M.S. *Tiger*, and has started business as the Maryland Point Electrical Works, at 2A, Water Lane, E. 15.

Mr. F. J. Lock, electrical engineer, of Station Road, Taunton, has resumed business on his release after nearly four years' service in the Army.

The Bradford Armature Winding Co. have commenced business at 479, Manchester Road, Bradford.

The *Financial Times* states that the three following engineering works, engaged in the manufacture of labour-saving material, have amalgamated :—Wellman, Seaver & Head, Ltd., the James Smith Hoisting Machinery Co., Ltd., and the engineering department of Rosebery Owen & Co., Ltd.

The Gattie System.—In a leaflet recently issued, Mr. Gattie's claims on behalf of his system of sorting goods are set forth in the form of "fourteen points," in the course of which it is pointed out that the transport charges in this country are the highest in the world, and impose a heavy handicap on our industries, the loss on the railways at present being estimated at 80 millions sterling per annum. Demonstrations of the system are given every Wednesday morning at the works of the New Transport Co., Ltd., in Battersea.

The Coal Exports Committee.—Arrangements having now been completed for the merging of the duties of the Coal Exports Committee with those of the Coal Controller, that Committee will on March 8th be dissolved.

Fire.—Damage to the extent, it is stated, of from £3,000 to £5,000, was caused by a fire at the works of the St. Helens Rubber and Cable Co., Ltd., Warrington. The damage by fire was confined to the testing department.

Bankruptcy Proceedings.—M. M. Soesan, electrical case fitter, 17, Museum Chambers, Bury Street, London, E.—Receiving order made, March 1st, on debtor's own petition. First meeting March 12th; public examination, April 8th; both at Carey Street, W.C.

A. Matson, electrical engineer, Stockton-on-Tees.—Supplemental dividend of 1s. 9½d. in the £, payable March 7th, at the Official Receiver's Office, Middlesbrough.

Lyons Fair.—Bastian Quartzalite fires and heating apparatus are being shown at the Lyons Fair by l'Appareilage Electrique Grivolas, the French agents of the Bastian Electric Co., Ltd., of London.

Converter Plant Control Order, 1918.—The Ministry of Munitions has suspended the operation of the above Order as from March 4th.

Reduction of Capital.—Sanders Rehders & Co., Ltd.—A petition for reducing the capital from £75,000 to £42,300 is to be heard on March 25th.

LIGHTING AND POWER NOTES.

Accrington.—Proposed Extensions.—The Electricity Committee has decided to engage Mr. Robert Blackmore, M.I.E.E., to report upon the proposed extensions at the electricity works.

Barmborough.—Mains Extensions.—Plans have been submitted to the Doncaster R.D.C. for the laying of a H.T. cable from the Mauvers Main Colliery to Barmborough; the matter will be reported upon at the next meeting.

Bexley.—Proposed New Station.—The electrical engineer suggests the establishment of a central generating station for Bexley Heath, Dartford and Erith, or, alternatively, the acceptance of a part supply in bulk from the adjoining authority, which will enable the Council to carry on until it is known what is actually to be done under the B. of T. scheme.

Birmingham.—New Power Station Site.—Further particulars are now available of the site for the future power station, referred to last week. In its report the Electric Supply Committee states that about 12 months ago the Director of Electric Power Supply of the Ministry of Munitions requested the Committee to consider the electric power requirements of Birmingham and the surrounding industrial districts, and the possibilities of supply therein. The investigations made it clear that whilst Birmingham was well situated for an ample coal supply, it was restricted as regarded water for condensing purposes. Prof. Boulton, of the University, indicated that the two possible sources of water for supplying cooling towers were the Staffordshire mines drainage water and the sewage effluent running to waste at Minworth. The amount there running to waste was ample for dealing with a station of 900,000-KW. capacity. The Hams Hall Estate is said to be ample to accommodate a station of 900,000-KW. capacity; it provides sufficient coal storage space, whilst the low-lying land could be used as an ash dump.

On the E.S. Committee's report, the chairman moved that the offer of Lord Norton to sell the estate be accepted, and that the Finance Committee be instructed to apply to the L.G.B. for sanction to borrow £38,000 to cover the purchase money. The new station, he said, was not required immediately, but the Committee was looking forward ten or more years. The justification for the proposal was to be found in the continuous growth of the electricity supply department. This year the gross revenue would closely approach a million sterling. Since the outbreak of war the revenue and output (160 million units per annum) had more than doubled. They could only judge of their future requirements by past experience. At the same rate of expansion, which might, however, be accelerated, the Nechells station would meet the city's requirements for 15 years. With regard to coal and water, last year they burned 314,000 tons of coal at a cost of £298,000. At Summer Lane there was in daily circulation nearly 30 million gallons of water, while at the new permanent station at Nechells, when developed to its full capacity, it was estimated there would be 84 million gallons in daily circulation. The presence of the sewage effluent was the determining factor in the selection of the Hams Hall Estate, the price of which was fair and reasonable. The report was approved without discussion.

Bolton.—Proposed Extensions.—The T.C. has been recommended by the Electricity Committee to apply for a loan of £1'0 000, for extensions at Back-o'-th'-Bank generating station.

Linking-up Scheme.—The L.G.B. has given sanction to the T.C. to borrow £7,500, for the purpose of linking-up the municipal electricity undertaking with that of the Lancashire E.P. Co.

Bradford.—Electric Cooking.—On February 21st and 22nd, the Lord Mayor entertained 1,400 repatriated prisoners of war to dinner. 700 dinners were served each night, and the whole of the food was cooked electrically.

Proposed Extensions.—The electricity department has signified its willingness to supply electricity in the Idle and Thackley districts as soon as there are sufficient prospective consumers.

Bray.—Proposed Extensions.—The U.D.C. has decided to apply for L.G.B. sanction to a loan of £5,000 for extensions of plant at the electricity works.

Burnley.—Hours of Labour.—In accordance with an agreement entered into between the Lancashire and Cheshire electricity undertakings and the Trade Unions, the T.C. has decided that the 47-hour week for employés of the electricity undertaking shall come into operation immediately.

Canada.—Electricity Statistics.—The Dominion Water Power Branch of the Department of the Interior, in conjunction with the Bureau of Statistics, has prepared a report on the present position of electricity supply in the Dominion, and the following is abstracted from a synopsis published in the *Electrical News*:—The total number of central stations on January 1st, 1918, was 666, of which 323 were company owned and 343 municipal. A large proportion of these took a supply in bulk from the Ontario Hydro-Electric system, and the number of actual generating stations was 470, of which 296 were company owned and 174 municipal. The plant installed was rated at a total of 1,844,571 H.P., of which 78·3 per cent. was company operated and 21·7 per cent. municipal; 1,652,661 H.P. was derived from water power, 180,200 from steam plant, and 11,710 from gas and oil plant. The average horse-power per thousand of population was 221 for the whole of the Dominion, Yukon having the highest of any Province, with 1,206 H.P. per thousand. Of the total electrical energy generated in Canada, 89·6 per cent. was derived from water power. The total number of employés engaged in central stations was 8,847, with salaries and wages aggregating $7,777,715 per annum. The capital invested in the electricity supply industry was $356,004,168, and the revenue from the sale of electricity in 1917 was $44,536,848. The average cost per horse-power installed, including capital charges, &c., was $193. The cost of construction of hydro-electric stations per installed horse-power, omitting distribution systems and similar charges, was $69·11.

Chelmsford.—Price Increase.—The B. of T. has informed the T.C. that the Order authorising the E.L. Co. to increase the price of electricity does not empower the company to make a minimum quarterly charge.

Chester.—Hydro-Electric Installation.—The borough electrical engineer, Mr. S. E. Britton, has issued a report on the working of the Corporation electricity department for the five years ended October 20th last, which contains the following comparison between the hydro-electric and steam installations:—

	Hydro-Elec.	Steam.	Total.
Units generated	8,622,015	9,625,819	18,247,834
,, used on works	354,986	1,763,804	2,118,290
,, used in distribution	967,600	939,200	1,906,800
,, sold	7,299,429	6,923,815	14,222,744
Generating costs	£5,370	£25,957	£31,327
Capital expenditure	£18,473	£55,992	£74,465
,, charges	£5,240	£16,215	£21,455
Income from sale of energy	£59,612	£56,540	£116,152

The great difference in the generating costs is largely accounted for by the cost of coal, of which 18,895 tons were used, at a cost of £16,217; it is estimated that the hydro-electric plant is saving between three and four thousand tons of coal per annum. The average price received for energy from the combined systems was 1·96d. per unit. The existing water power installation is capable of developing 600 H.P., and at times the maximum flow of water at the weir amounts to 2,800 H.P. Although the whole of this could not be economically developed, the engineer recommends that further steps be taken to utilise water power.

Continental.—Spain.—Our special correspondent in Spain writes:—Don José A. Gayoso has been authorised to use 2,000 litres of water per second from the River Neira. He proposes to construct a canal 1,309 metres long, and will thus obtain a fall capable of developing 200 H.P. during the dry season. Two turbo-generators will be installed, and the energy generated will be used to augment the existing supply in the town and district of Sárria. Energy will be transmitted from the new power house at 10,000 volts pressure.

The use of 20,000 litres per sec. from the River Aragon at a head of 18·1 metres, has been granted to Messrs. Mugica, Arellano y Cia at Gallipienzo (Navarra) for industrial purposes.

The proprietors of the Central Eléctrica, of Quiros, solicit the use of 1,000 litres per sec. from the River Ricabo. The water would be conducted by a canal 1,362 metres long to the existing power house.

Don Juan Uria has asked for the concession of 4,000 litres per sec. from the River Quiros, for the production of motive power for industrial uses. It will be necessary to build a dam across the river, and a canal 3,304 metres long. On account of the rough nature of the country, nine tunnels must be cut for the passage of the canal.

A concession has been granted for the utilising of the water power of the River Araguil, near Asiain (Zaragoza), for the generation of electricity.

Germany.—A large State-controlled scheme for the generation and supply of electrical energy in Germany is said to be in course of preparation by the German Ministry of Finance. The aim is to bring about the most economical and most rational exploitation of Germany's sources of generation of electricity. There are in Germany over 4,000 electricity works, and according to the *Engineer*, the less profitable concerns are to be abandoned, and those more

favourably placed are to be helped and extended. The country is to be divided into a number of supply districts, within which the different works will be made to co-operate so as to avoid undesirable competition. The scheme comprises the exploitation both of the coal deposits in Northern Germany and the water power in the more southerly districts.

Strike.—The Independent Socialist Party declared a general strike in Berlin on Monday. The electricity supply was cut off in several districts, and the tramway system ceased working.

Coventry.—Extensions.—The Electricity Committee recommends that a cable be laid, at an estimated cost of £15,260, to the new works of the Peel-Conner Telephone Co., which is to undertake to take a supply for at least three years, and that at least £8,000 be paid per annum for the supply.

Dundee.—Proposed Extensions.—The Electricity Committee has obtained 190 poles of land, in the neighbourhood of the Carolina Port generating station, for extensions.

Edinburgh.—Consulting Engineer's Fees.—At a meeting of the T.C., the chairman of the Electricity Committee, in reply to a question, said that the remuneration of the consulting engineer in connection with the new Portobello power station would receive consideration. The Lord Provost remarked that 4 per cent. on a capital expenditure of £1,000,000 amounted to a large sum, and the point was worth looking into.

Faversham.—Extensions.—The R.D.C. has consented to the T.C. supplying electricity to the shipyard of J. Pollock, Sons and Co., The Brents, and to premises at Ospringe, which is outside the borough.

Grimsby.—Proposed Extensions.—In view of the fact that the Corporation and the Great Central Railway Co. require additional plant for their generating stations, the Corporation has decided to ask the Railway Co. if it will take a bulk supply from the Corporation's station.

Halifax.—Salaries.—The Electricity Sub-Committee has recommended that the application of the E.P.E.A. for increased salaries for the technical staff be granted, and that payment be made from March 31st last.

Mains Extensions.—The Tramways and Electricity Committee has been authorised to lay about 1,000 yards of E.H.T. mains to Hebble Mills, and to install the necessary switchgear and transformer, at an estimated cost of £905.

Haslingden.—Proposed Extensions.—The Tramways and Lighting Committee has decided to apply to the L.G.B. for sanction to a loan of £2,000 for services.

Herne Bay.—Mains Extensions.—The U.D.C. has consented to the laying of underground mains for the supply of electricity for lighting and power by Messrs. Hunt & Sons.

Heywood.—Price Increase.—The T.C. has decided to increase the charges for electricity from April 1st by 10 per cent. for lighting and by 5 per cent. for power.

Hull.—New Plant.—The Electricity Committee has authorised the acting electrical engineer to purchase a motor and switchgear, at a cost of £5,805.

Garden City Lighting.—The Committee has decided to canvass the residents of the Garden City with reference to installing electric lighting, and to consider the question in connection with new housing schemes.

Ilford.—Street Lighting.—The borough electrical engineer has reported that a large number of public lamps and fittings require renewal, and recommends that the new lamps be fixed on brackets, instead of on the poles at present in use. He also recommends that the public lamps, which are at present controlled by 30 switch pillars, be connected to the works and controlled from there.

Ireland.—Lighting Restrictions.—Owing to the increased supplies of coal, the Lighting Restrictions Order has been considerably relaxed.

Leicester.—Proposed New Plant.—The Corporation electrical engineer (Mr. T. R. Smith) has reported that the demand for electricity continues to increase, and that the generating plant is already fully loaded. As the proposed new station cannot be in operation for at least three years, he suggests the installation of a 5,000-kw. turbo-alternator, with accessories, and the replacement of the six old boilers by two large modern water-tube boilers, with economisers, &c., at the Aylestone station, to cope with the load during the next two or three years. The whole of this plant could be moved to the new station when available. One firm has offered to deliver the turbo-alternator, &c., within four months; the total cost is estimated at £100,000. The maximum capacity of the existing plant is 8,750 kw., and it is often called upon to supply 10,000 kw., while applications have been received for a further 3,500 h.p., which cannot be supplied. The Corporation applied for sanction to build a new power station in 1917, but owing to war conditions this was refused by the B. of T. The total cost of the new station is put at £140,000, and the Electricity Committee has recommended the Corporation to appply for L.G.B. sanction to borrow this sum, and to promote a Parliamentary Bill for the acquisition of Freeman's Meadow as a site for the power station.

London.—Battersea.—Proposed Loan.—The Finance Committee has recommended the L.C.C. to sanction the borrowing of £15,730 by the B.C., for the installation of a new boiler at the electricity works.

Islington.—Proposed Loan.—The L.C.C. has been recommended by the Finance Committee to sanction a loan of £72,000, for electricity purposes, by the B.C. The loan is in respect of the increased cost of plant, which was estimated to cost £53,000 in August, 1917. The original scheme has not been varied, the excess being caused by the extra cost of labour and materials.

Manchester.—Proposed Price Increase.—The Finance Committee has approved a recommendation of the Electricity Committee that the charges for electricity be increased. The proposed advances are from 40 to 60 per cent. for lighting and domestic purposes; from 50 to 85 per cent. for power; and from 20 to 30 per cent. for large power consumers. The charges for the hire of motors and for the delivery and fixing of new motors are to be increased by 25 per cent.

Morecambe.—New Plant.—The Electricity Committee has decided to spend £4,000 on new plant.

Peterborough.—Proposed Extensions.—The T.C. has circularised the manufacturing firms within its area, in order to ascertain the probable demand for electricity, and whether it will be justified in carrying out the proposed extensions.

Street Lighting.—The acting electrical engineer has been instructed to attend to the irregular working of the automatic public lighting controls.

Pontefract.—Price Increase.—The Yorkshire Electric Tramway Co. has informed the B. of G. that as from January 1st the price of electricity will be advanced by 20 per cent., with a sliding scale based on the cost of labour and coal.

Salford.—Extensions.—The Electricity Committee has decided to supply electricity to the Malleable Steel Castings Co., Pendleton, at a minimum of £2 per kw. and an annual payment of not less than £800.

South Africa.—Water-Power Rights.—The Rand Mines Power Supply Co. has intimated its intention of applying for Parliamentary authority to use the water to be impounded in the Vaal River by the Rand Water Board. Negotiations with this end in view have been proceeding for the past four years, but no satisfactory agreement could be arrived at between the company and the Board, and the Board has decided to opppose the company's Bill on the ground that it is a direct challenge to its powers in respect of the Vaal River scheme.—*South African Mining Journal and Engineering Record.*

Cape Town.—The city electrical engineer has reported that the condition of the plant causes the supply of electricity to be "critical in the extreme." About 15 months ago the blades of one of the turbo-generators were found to be defective, and an order was placed with the makers for a new set, which was to be received at Cape Town before the end of February. This turbo-generator recently broke down completely, and a new 3,000-kw. set, which was delivered about 15 months ago, was also put out of action owing to the rotor burning out. The supply then depended upon one turbo-generator and two very old Ferranti sets.

Stalybridge.—Proposed Loan.—The Stalybridge, Hyde, Mossley and Dukinfield Electricity Board has decided to apply for L.G.B. sanction to a loan of £92,000 for electricity purposes.

Waterford.—Proposed E.L.—The Corporation has appointed a Committee to consider the acquisition of the local National Shell Factory, with a view to converting it into an electricity generating station.

Watford.—Proposed Loan.—The U.D.C. has applied for a loan of £6,100, for extensions to the electricity distribution system.

Wigan.—Price Increase.—The Corporation has increased the electricity charges, from April 1st, by a further 15 per cent., making a total of 40 per cent. over scale prices.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—Whitley Committee.—The Tramways Committee has approved a scheme for a Works Committee on the Whitley model, for semi-skilled employés.

Colne.—Fare Revision.—The Corporation has adopted a new scale of fares, which includes 1d. for ½-mile stages and 1½d. for 1-mile stages.

Halifax.—Tramcar Alterations.—The Corporation tramcars are to be fitted with covered-glass fronts, for the protection of the drivers.

Huddersfield.—Sunday Service.—The resumption of the Sunday tramway service is still held in abeyance by the action of the men in refusing to work unless they are paid double time for Sunday labour. The T.C. has offered time-and-a-half rates, but this has been refused.

London.—Accident.—A tramway-car and a motor lorry collided in Cambridge Road, E., on Thursday, last week. Four persons were injured and removed to hospital.

L.C.C. Extensions-Opposition.—It is said that the City Corporation may oppose the proposed L.C.C. Bill for extending the tramways to link-up North and South London. One objection made is that congestion is likely at a place like Ludgate Circus.

The L.C.C. Highways Committee reports that over 600 tramcars, out of a total of 1,662, are being repaired. During the past few weeks, 288 axles have broken, compared with 127 during the whole of 1914, when more cars were in service. The cause is attributed to the overloading of the cars, the recent frosty weather, and the general depreciation of the cars, due to abnormal war-time conditions. The restricted service due to broken axles will be relieved by the middle of this month, but any further increase depends upon the rate at which spare parts and materials for repairs can be obtained.

Much inconvenience was caused by the failure of the electric power on the L.C.C. tramway system between Camberwell Green and the Elephant and Castle, on Friday morning last.

Manchester.—New Cars, &c.—At a meeting of the Tramway Committee, it was stated that about 50 new tramcars were being built, and tenders for the supply of motors, trucks, bodies, and rails, to the value of £150,000, had been accepted. About 700 employés had been demobilised.

Northampton.—Sunday Service.—After a suspension of about six months, the Sunday service on the Corporation tramway system was resumed last week.

Tramway Men's Wages.—A conference between the Municipal Tramways Association, the Tramways and Light Railways Association, and the National Transport Workers' Federation was held at Birmingham last Friday, on the hours of labour and conditions of employment of tramway men. A discussion took place in private, but it was stated that no real progress had been made. A Sub-Committee was appointed to make further inquiries, and to report at another conference to be held at Manchester to-day.

Portsmouth.—Women Employes.—To avoid swelling the ranks of the unemployed, the Corporation is not discharging women tramway workers.

United States.—Strike.—An Exchange message states that the workers on the New York tube railways struck work on Tuesday morning in sympathy with the marine workers, and the tubes under the Hudson River were stopped.

TELEGRAPH AND TELEPHONE NOTES.

Cable Censorship.—Mr. Churchill, replying to a question in the House, said that the Government was very desirous of abolishing the censorship as soon as it was possible to do so, but it was essential that it should be maintained at present. Cable delays did not arise mainly from censorship, but from congestion due to cable interruptions and other causes.—*The Times.*

Cable Delays.—According to the daily Press, City firms report cable delays far worse than during hostilities; the complaint is general. Cables from Singapore and Shanghai are now taking five or six days, and in some cases ten days; from Sydney, nine days; from Melbourne, eight days; and from Pretoria, six days. It is stated that Government departments are mainly to blame for the delays by sending excessively long messages which have priority over private messages.

A cable, last week, took five days to reach London from Amsterdam, whilst a message takes six days to reach Athens and five days more to reach Colombo than before the war. Business people find it quicker and much cheaper to do business by mail rather than by cable. The inland telegraph system is no better; a wire handed in at London took nearly three hours to reach Glasgow, and a Press dispatch took nearly six-and-a-half hours to arrive.

The *Daily Mail* explains that the eastern cable traffic has increased two-and-a-half times on pre-war figures; two of the six cables are interrupted, and the breakdown of the cable between America and the Far East, a few days ago, happened at an unfortunate time. There were interruptions on eight of the twelve cables to Holland. On Saturday news was received that one cable had been repaired in mid-Atlantic.

The Indian Section of the Manchester Chamber of Commerce, at a meeting last week, decided to make urgent representations to the President of the B. of T. and Postmaster-General that cable delays have increased during the last fortnight, and that trade with the Far East is being interfered with.—*The Times.*

France.—The powerful wireless station now in course of construction near Bordeaux by the American Army has been sold by the United States to the French Government.

Germany.—According to a Government announcement, the Imperial Wireless Committee, which was entrusted with the unification of the German wireless system, has created an Imperial Wireless Telegraph Administration, divided into seven departments. The Imperial Postal Administration has appointed Herr Bredow to be director of a special department for wireless telegraphy, which was formerly a section of the telegraph and telephone system. He is to amalgamate the entire wireless telegraph system, including the naval and military stations, so far as they are not imperatively necessary for the purely military service.

In the naval terms of the next and final Armistice, which, according to the *Times*, have been agreed between the Allies, it is provided that the German cable system, comprising 14 cables—European, trans-Atlantic, and Asiatic—will now be returned to its previous owners. The wireless stations of Nauen, Hanover, and Berlin are not to be used for any but commercial purposes. Permission to use these stations for military and political purposes will only be given when the military conditions of the Peace Treaty have been carried out. Meanwhile, the Allies will determine the wave length to be used by German stations, and will supervise the German use of the stations. The same conditions will be applied to the Austrian wireless stations at Vienna, Budapest, and Pola.

Holland.—Owing to the interruption of several of the cables between this country and Holland, an auxiliary wireless service has been provided by the British and Dutch Post Offices, pending the completion of the cable repairs which are now in hand. Telegrams should be marked "*via* wireless." The charge will be the same as for the service by cable—namely, 2d. a word.

Wireless in the Air Service.—It is understood that the Government is taking steps to compel commercial airships and aeroplanes to carry wireless telephone or telegraph installations. The larger machines of both types may have to carry both wireless telegraph and telephone installations, the former for accurately fixing their position at night or in fog by communicating with long-distance "compass" stations which give the pilot his angular direction, and the telephones for speaking to passing aircraft and making arrangements with aerodromes for landing.

The Telegraph Service.—In the House of Commons, on Monday, the Postmaster-General stated that the estimated loss on the telegraph service for 1917-18 was about £556,000, but the conditions were abnormal, and the estimate was not an adequate criterion of the normal financial result. A full statement on the subject was to be published soon. Before the war the loss on Press telegrams was estimated at over £200,000, but although there had been a considerable reduction in the volume of Press work, the saving had probably been off-set by the increased cost of materials and wages.

Wireless Telephony.—Mr. Godfrey Isaacs, managing director of the Marconi Wireless Telegraph Co., has informed a Press representative that the company expects early next year to have in operation a commercial service of wireless telephones between London and New York. At first it may be necessary to make the calls from central offices, but the company is hopeful of being able to introduce methods for relaying the messages over private wires. This, it is claimed, will mean that British and American subscribers will be able to carry on a desk-to-desk conversation by merely lifting the receiver off the hook and asking the exchange for the desired oversea number.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdare.—March 3rd. Electricity & Tramways Department. Three double-deck tramcars. (See this issue.)

Australia.—Sydney.—April 28th. City Council.* Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. (January 31st.)

Melbourne.—Commonwealth. March 11th. P.M.G.'s Department. Covered and braided wire, schedule 1,510; telephones and diaphragms, schedule 1,505. (February 28th.)

March 18th. Bronze and copper wire, schedule 1,509. (February 28th.)

Queensland.—March 26th. P.M.G.'s Department. Telegraph and telephone material, schedules 447/451 and 453. (February 21st.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

Aylesbury.—Corporation Electricity Department. One 1,000-KW. generating set complete; two 500-KW. rotary converters. (February 14th.)

March 10th. Laying cable and wiring infirmary for the B. of G. Workhouse Master.

Belfast.—March 12th. Electricity Department. Six or 12 months' supply of stores, including electrical items. (February 28th.)

Dublin.—March 19th. B. of G. Supply of electrical fittings for three or six months. Specification from the office of Master of the Workhouse.

Liverpool.—March 17th. B. of G. Electrical supplies for three months for Guardians of Toxteth Park. Clerk to Guardians, 15, High Park Street, Liverpool.

London.—HAMMERSMITH.—March 12th. B.C. Stores for the electricity department for 3, 6 or 12 months. (February 28th.)

ISLINGTON.—March 19th. Corporation of London. Electrical work at the Metropolitan Cattle Market. (February 28th.)

Manchester.—March 11th. Tramways Committee. Supply, &c., of (*a*) permanent-way special track work; (*b*) permanent way points, tongues, and hardened steel centres. Mr. J. M. McElroy, general manager.

March 11th. Tramways Committee. Stores, including several electrical items. (February 21st.)

Macclesfield.—March 17th. Six months' or one year's supplies of electrical goods for Cheshire County Asylum, Parkside. Mr. G. F. Tingay, Clerk of Asylum.

Mansfield.—Corporation Electricity Committee. 1,250-1,500-KW. turbo-alternator, condensing plant, 500-KW. rotary converter, transformer, and switchgear. (February 14th.)

Rochdale.—March 13th. Tramways Committee. Stores for one year. Particulars from Mr. G. Webster, General Manager, Tramway Offices, Mellor Street.

Stockton-on-Tees.—March 12th. District Fund, Gas and Electricity Committees. Articles and stores for six months. (February 28th.)

Taunton.—Electricity Department. One 500-KW. steam turbine generator, travelling crane, cables and meters. (Feb. 14th.)

Warrington.—March 19th. B. of G. Electrical goods for three months. Mr. A. Bottomley, Clerk, Bewsey Chambers.

CLOSED.

Canada.—The contracts for building the first two new units for the hydraulic development of Niagara River for the Hydro-Electric Power Commission of Ontario have been placed with the American House of Wellman, Seaver & Head, Ltd., of London. These units are to develop 52,500 H.P. each, and will be the largest which have yet been installed.—*Birmingham Post.*

Leicester.—T.C. Accepted:—

One 5,000-KW. turbo-alternator, switchgear, two 1,000-KW. rotary converters, condensers, superheaters, economisers, stokers, steel chimneys and pumps, &c., £80,000.—Messrs. Dick, Kerr & Co.

Manchester.—The Tramways Committee has accepted tenders to the amount of £150,000, for tramcar motors, trucks, bodies and rails. 50 new cars have already been laid down, out of the first instalment of 100.

Salford.—Tramways Committee. Recommended:—

12 M.I. gear cases, £98; 12 do. do. £107.—British Westinghouse Co.
72 life-guard cradles, without laths, £144.—Joseph Bowring.
Electrically welding and retreading 400 track joints, £1,000 (approx.).—Rail Welding Co.

Electricity Committee. Accepted:—

700 yd. ·1 sq. in. cable, at £497.—W. T. Glover & Co.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, March 7th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Warming Buildings by Hot Water," by Mr. M. H. Jones.

Manchester Association of Engineers.—Saturday, March 8th. At the Grand Hotel. At 6.30 p.m. Paper on "Automatic Machines," by Mr. H. E. Thomas.

Birmingham and District Electric Club.—Saturday, March 8th. At the Grand Hotel. At 7 p.m. Paper on "Electric Welding as a Commercial Proposition," by Mr. H. W. Wolton.

National Foremen's Association of Engineering and Allied Trades (West London Branch).—Saturday, March 8th. At 6.30 p.m. At the Norfolk Arms Hotel, Burwood Place, Edgware Road, W. Ordinary meeting.

Royal Institution of Great Britain.—Saturday, March 8th. At Albemarle Street, W. At 3 p.m. Lecture on "Spectrum Analysis and its Application to Atomic Structure," by Prof. Sir J. J. Thomson.

Chief Technical Assistants' Association.—Saturday, March 8th. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Annual general meeting. Adjourned discussion on "Problems in Connection with Linking-up."

Royal Society of Arts.—Monday, March 10th. At 4.30 p.m. At John Street Adelphi, W.C. Cantor lecture "Fuel Economy," by Prof. W. A. Bone, F.R.S. (Lecture I.)

Wednesday, March 12th. At John Street, Adelphi, W.C. At 4.30 p.m. Paper on "Electric Welding and its Applications," by Mr. W. L. Lordon.

Thursday, March 13th. At John Street, Adelphi, W.C. At 4.30 p.m. Paper on "The Report of the Indian Industrial Commission," by Mr. D. T. Chadwick, Indian Trade Commissioner.

Society of Engineers (Inc.).—Monday, March 10th. At 5.30 p.m. At the Geological Society, Burlington House, Piccadilly, W. Paper on "Experiments with Clay in its relation to Piles," by Mr. A. S. E. Ackermann, B.Sc.

Industrial Reconstruction Council.—Tuesday, March 11th. At the Institute of Journalists, Tudor Street, E.C. At 6 p.m. Conference on "Labour Conditions in Relation to Future Industrial Prosperity," to be opened by Capt. J. O. Grady, M.P.

Institution of Civil Engineers.—Tuesday, March 11th. At 5.30 p.m. At Gt. George Street, S.W. Discussion on the following papers: "Electric Welding Developments in Gt. Britain and the U.S.A.," by Major J. Caldwell and Mr. H. B. Sayers; on "Experiments on the Application of Electric Welding to Large Structures," by Mr. W. S. Abell; and on "The Application of Electric Welding to Ship Construction and Repairs," by Mr. J. R. Smith.

Association of Engineers-in-Charge.—Wednesday, March 12th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Recent Developments in Engine Steels," by Capt. L. Aitchison.

Institution of Electrical Engineers.—Thursday, March 13th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Lecture on "Dielectrics in Electric Fields," by Mr. G. L. Addenbrooke.

(North-Eastern Centre).—Monday, March 10th. At the Mining Institute, Newcastle-upon-Tyne. At 6.45 p.m. Discussion on "The President's Address to the Territorial Centres."

(North Midland Centre).—Tuesday, March 11th. At the Metropole, King Street, Leeds. At 7 p.m. Paper on "The Effect of Air and Water on Material used in Engineering Works," by Mr. H. E. Yerbury.

(North-Western Centre.)—Tuesday, March 11th. At 7 p.m. At the Engineers' Club, Manchester. Paper on "Large Power Transformers," by Mr. A. G. Ellis and Mr. J. L. Thompson.

(Scottish Centre).—Tuesday, March 11th. At Princes' Street Station Hotel, Edinburgh. At 7 p.m. Paper on "The Functions of the Engineer: his Education and Training," by Lieut. Bt.-Col. W. A. J. O'Meara, C.M.G.

NOTES.

British Scientific Products Exhibition, 1919.—The King has consented to act as Patron of the British Scientific Products Exhibition, 1919, which will be held at the Central Hall, Westminster, during the month of July. The president of the Exhibition is the Marquess of Crewe, K.G., and Prof. R. A. Gregory is chairman of the Organising Committee.

The British Science Guild has been encouraged to organise this Exhibition by the success which attended that held at King's College last summer, and the more recent Exhibition at Manchester. Now that many inventions can be shown which could not be put before the public during the war, there is every prospect that this year's Exhibition will be even more successful than its predecessors. The objects of the Exhibition will be to illustrate recent progress in British science and invention, and to help the establishment and development of new British industries. Firms desirous of exhibiting are invited to communicate with the Organising Secretary, Mr. F. S. Spiers, 82, Victoria Street, London, S.W. 1.

National Electricity Supply.—The scope of the Ministry of Ways and Communications which it is proposed to set up, was explained to the House of Commons on Wednesday last in a 10 minutes' speech, by the Home Secretary. The new Ministry is, it is proposed, to take control of the electricity supply, tramways, railways, light railways, canals, waterways and inland navigation, roads, bridges, ferries, vehicles, and traffic regulations. In addition the Bill also gives the new Ministry control of public services, taxicabs, harbours and docks, piers, and possible acquisition of all or any. Mr. Shortt explained that the new Ministry could not nationalise the railways on its own initiative; any such proposal would have to go first before the House. Regarding the proposal to control electricity supply, he admitted that at first sight that might excite differences of opinion, but he pointed out that "transport was probably the biggest and most permanent customer for electricity," and that the success of transport undertakings depended on the development of the industry of the country. The more industry, through the provision of cheap power, was enabled to increase its output, the more the transport services would prosper, and therefore there was every inducement for the railways to see that every manufacturer who could improve his business by the use of cheap power should be enabled to get that power. The Bill will apply to the whole of the United Kingdom.

In the House of Commons on Wednesday, in reply to Mr. George Terrell, Mr. Bridgeman (Secretary, Board of Trade), said that the President of the Board hoped that it would be possible to introduce a Bill dealing with the supply of electricity in the course of a few days.

Coal Control.—The President of the Board of Trade has appointed Sir Evan Jones, Bart., M.P., Controller of Coal Mines, in succession to the late Sir Guy Calthrop. Mr. W. A. Lee will continue to act as Secretary of the Department, and will be responsible for dealing with export and prices questions.

U.S. Scientific Attaché in London.—According to the American journal *Science*, Major C. E. Mendenhall has been appointed Scientific Attaché to the United States Embassy in London, and will come to England almost immediately. Major Mendenhall is Professor of Physics in the University of Wisconsin, and has been given leave of absence for the purpose. It is expected that he will be able to supply his Government with valuable information as to the progress of scientific research in this country, especially in its industrial applications.—*The Times*

Miners' Electric Safety Lamps.—At a meeting of the North of England Branch of the National Association of Colliery Managers, at Newcastle-on-Tyne, in November last, the Branch President's "Notes on the Ceag Miner's Electric Safety Lamp" were submitted for discussion. Replying to criticisms advanced at previous meetings, the author said that he thought lightning arresters ought to be installed in all collieries where charging stands were used. Referring to cell explosions due to the leakage of acid through a punctured cell, he described the following experiments that he had made. A cell was filled with acid of a specific gravity of 1.250, which was allowed to escape through the cell being punctured at its base. In ten seconds after the cell was empty brilliant arcing was noticed about the cross, and smoke was given off; this continued for 50 seconds. During the next six minutes only a small quantity of smoke was given off; then arcing was again noticed, and a large increase of smoke, which continued for one minute, till a hole 2 in. by ¼ in. was burnt through the side of the cell, when it ceased. For the next fifteen minutes a small quantity of smoke was given off, and then increased strongly for six minutes. By this time the bottom half of the case had smouldered away. The cell then collapsed, causing the plates to fall together; simultaneously there was a flash at the contacts at the top of the cell, which caused the already heated cell to catch fire. The duration of the experiment was thirty-five minutes. Another experiment was carried out under exactly similar conditions, and after ten minutes it was found that the cross in the cell was burnt in two places to the extent of ¾ in. by ¼ in. In a third experiment the cell was covered as far as possible with sheet mica, the separation cross being dispensed with and mica substituted. With these exceptions the experiment was conducted as before. There was no visible arcing, but a vapour was given off, which ceased after five minutes, and current still continued to pass through the plates. After 30 minutes the current was cut off, and when examined the cell was found to be undamaged, but the mica separator was charred, which probably accounted for the current being able to make a circuit of the plates. During the first experiment recorded above, the sliding rod or variable resistance, which was held in position by a solenoid coil, dropped as soon as the first flash appeared in the cell, and to allow the experiment to succeed the sliding arm had to be held in position. Therefore, it seemed to be highly improbable that a fire would take place through a leaking or dirty cell on the battery, if the sliding arm of the resistance was in good working order. He suggested that with attendance any tendency to fire ought to be detected before any material damage was done. The cross was the danger zone, and in all cases of acid cells he would substitute a mica cross, and also line the cell with sheet mica. By introducing "jellac" instead of the acid this danger was very nearly overcome, because in his opinion, if the acid and "jellac" were mixed in the right proportions, there was practically no leakage or spill, thereby obviating the occurrence of an arc with a fire to follow.

Mr. S. Hare thought that every charging cabin should be divided up into compartments, which should be made fireproof, so that in the event of a cell taking fire in any one compartment it could be dealt with before it extended to other divisions of the charging house.

Mr. G. Raw said that until the celluloid case could be superseded by a non-inflammable one, the danger of fire during charging would remain. The only safe course was to keep the charging cells under proper supervision, and, if possible, in separate partitions. With regard to the "jellac," he regarded its alleged satisfactory results with a certain amount of scepticism, because there was unavoidably a certain amount of wasting of the plates, and unless the resulting sediment could fall to the bottom of the cell clear of the plates, as in the dilute electrolyte, he foresaw trouble with the plates in time.

The Branch President said he had had a cell punctured for six months; very little "jellac" had leaked out of it yet, and no fire had occurred. When a fire took place in the Ceag lamp it occurred at the cross-pieces. If these were kept clean there was no chance of a cell taking fire.

The Metric System in the United States.—At the second annual meeting of the American Metric Association, held in Baltimore on December 27th, and in Washington on December 28th, Mr. David A. Molitor, consulting engineer, outlined his work for the C. E. Schmidt Co., of Detroit, tanners. He found that about 500 different commodities were being purchased for the use of this company, and that they were received in many different units of weight and measure. It became clear that economy would be effected by entering the weight or measure of all material received in metric units. This step was taken with great success. The metric weights and measures were then used exclusively throughout the factory. The output of the factory was increased approximately 50 per cent. with the same working staff. The weighing in one department had previously been done by an expert in the old weights and measures. After the change to the metric system, this work was done by a labourer, with fewer mistakes than formerly. He estimated that a saving of approximately 20 per cent. could be effected in the book-keeping and calculations of factories which introduced the metric weights and measures throughout.

Dr. C. O. Mailloux, consulting engineer, chairman of the United States Committee of the International Electrotechnical Commission, told of his practical experiences in the use of the metric system in the United States and foreign countries, and described his last interview with Sir John Wolfe Barry. He expressed to Dr. Mailloux his firm conviction of the desirability and necessity for adopting the metric weights and measures in England, and discussed the practical steps contemplated for their general use. Dr. Mailloux pointed out the fact that the electrical units throughout the world were based on metric weights and measures, and that this in itself was indicative of their ultimate adoption for all purposes in America and England.

Mr. Jesse M. Smith, past-president of the American Society of Mechanical Engineers, stated that he had been in close touch with the metric movement for fifty years. He had studied in Berlin during the winter following the Franco-Prussian war; the metric system was then used in the text books, and also for practical work throughout Germany. He had frequently used the metric system in America and other countries since then, and believed it to be only a question of time when the metric system would be adopted in all parts of the world.

United States Senator John F. Shafroth read a Bill which he had introduced in Congress, and asked for a discussion on the subject. This Bill was a step toward the general use of metric weights and measures, making exceptions where such seemed to be advisable for special work. The Bill was endorsed by the American Metric Association.

Secretary of Commerce Hon. William C. Redfield was the principal speaker at the "Metric Dinner," held on the evening of the 27th. After outlining his practical experience as a manufacturer for thirty years, and his travels in other countries in the interests of his export trade, he voiced the conviction that the metric weights and measures should and would be adopted for general use in the United States.

Resolutions were passed expressing the desire of the American Metric Association to co-operate more fully with American industries and trades using and contemplating the use of metric weights and measures, and inviting the co-operation of the universities, colleges, and other educational institutions in bringing in the general use of metres, litres, and grams for the welfare of America.

Colliery Cable Unprotected.—Following a fatal mishap in a mine, when a workman received an electric shock through coming in contact with a pull, or signal wire, William Cary, manager of the Kingston Colliery, Hyde, and William M. Reynolds, managing director of the company, were fined £1 and £5 respectively, at Hyde, for allowing a cable in the mine to be unprotected, and Cary was fined £5, and witnesses' fees, for not adequately preventing the signal wire from touching the cable.—*Manchester Daily Dispatch.*

Radiotelegraphy in the U.S. Navy.—In the annual report of the U.S. Navy, a good deal of the engineer-in-chief's section is devoted to the activities of the Radio Division of the Bureau of Steam Engineering. There are 4,000 installations on naval ships and other craft built and being built, while on shore the Bureau maintains about 210 stations. "The Bureau," says Rear-Admiral R. S. Griffin, "has developed, or assisted in the development of, the use of radio for fire control, the radio-compass, underground radio reception, the distant control of radios-tations, the radio-telephone transmitter, and radio equipment for aircraft. A large number of the units of the fleet have been equipped with radio-compasses and radio-telephone transmitting and receiving sets, both apparatus of the greatest practical value. There are 25 radio-compass stations ashore for locating enemy vessels and unauthorised radio-stations, and for assisting vessels to determine their positions."

The development of radio-telegraphic communication from aircraft in flight to stations on land has been so advanced that it is now possible at a distance of 200 miles, or from land to flying aircraft up to 50 miles, and communication from aircraft resting on the water to points on shore can be effected at a maximum distance of 40 miles. The development of a radio-telephone for use on aircraft has progressed to such an extent that it is now possible to communicate from aircraft in flight to land stations at a maximum distance of 60 miles, and from land stations to flying aircraft up to 15 miles.

Electricians and Engineers in Newspaper Offices.—We have received from Mr. W. J. Webb, London district secretary of the Electrical Trades Union, a copy of a new working agreement for electricians and engineers employed in the newspaper offices in the London district. The agreement states that the hours for men on day work are to be 47 per week, and on night work 42; day work is comprised between 8 a.m. and 6 p.m., and night work between 6 p.m. and 6 a.m. Overtime is to be paid for at the rate of time and a half for the first four hours, and double time afterwards. The minimum wages are:—

	Day.	Night.
Electricians (mechanics) and engineers ...	£4 10 0	£6 0 0
Electricians' assistants	£3 15 0	£4 5 0

Other provisions relate to working days, rotating shifts, Sunday papers, &c. The agreement is terminable by three months' notice, and came into operation at the beginning of February. Disputes are to be referred to a joint committee of the Newspaper Proprietors' Association, the Electrical Trades Union, and the Amalgamated Society of Engineers.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following arrangements have been made for the first four informal meetings which, by kind permission, will be held in the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to No. 335, High Holborn, W.C., at 7.30 p.m. :—

March 17th.—Discussion on the Future of Trade Unions as Affecting the Engineering Industry. (Introduced by Mr. F. Pooley.)

April 14th.—Discussion on Electrical Instruments. (Introduced by Dr. R. D. Gifford.)

May 12th.—Discussion on the Regulations Issued by Electricity Supply Undertakings. (Introduced by Mr. W. E. Bradshaw.)

June 2nd.—Discussion on Increased Output, &c. (Introduced by Major Kenelm Edgcumbe.)

Arrangements are being made for visits to works on the afternoons of the above meeting-days (except the first). Particulars will be announced at the first meeting.

At the Irish Centre, on Thursday last week, Mr. G. Marshall Harriss, general manager of the Dublin United Tramways Co., read a paper on the subject of "Irish Rivers as Aids to the Distribution of Cheap Power." Mr. Harriss pointed out the necessity of increasing the output of agriculture—the most important industry in Ireland—in order to compensate for the higher wages and shorter hours demanded by the workers, and stated that for this purpose cheap power was essential. Owing to the cost of imported coal they must utilise water power as fully as possible, and he gave particulars of a proposal which was being considered by the Board of the Dublin and Lucan Electric Railway, to utilise the water-power of the Salmon Leap, Leixlip, to operate the railway. Mr. Harriss said that by this means a gross annual output of 8,385,000 units could be generated, equivalent to a consumption of 10,700 tons of coal. While water power was variable in amount, this drawback could be overcome where a public supply of electricity was available, by drawing from the latter when the water was deficient, and paying back electrical energy when it was abundant. On this basis the extension of transmission lines throughout the country for agricultural purposes would be justified. State aid would be necessary, but private enterprise should also be encouraged and protected.

Institute of Metals.—Mr. C. M. Walter, M.Sc. (chemist and engineer in charge of the Industrial Research Laboratories, Birmingham Gas Department), lectured last week at a meeting of the Birmingham Section of the Institute. After speaking of the electric muffle and oven furnaces of the "wire-wound" and "resister" types, he remarked that in the case of a special design of tubular furnace, the application of electrical heating had been found to give excellent results for certain classes of work, and already a number of such designs had been placed on the market by a Birmingham firm (Messrs. Kynoch) which had taken up the manufacture of electrically-heated furnaces of this particular type.

Electrical Power Engineers' Association (Glasgow Section).—The members of the Section are holding a dinner at the Trades' House Restaurant, Glasgow, on Saturday, March 22nd.

Stoke-on-Trent Engineers' and Engineering Students' Association.—On February 22nd the first annual festival of this Association was held; founded in 1914, it has now 500 members. The Mayor (Alderman W. E. Robinson) presided, and among those present were Mr. R. Smith (president), Mr. W. M. Selvey, Mr. C. H. Yeaman (past president), and Mr. E. Jolley (secretary). In the course of the evening it was urged by Mr. Yeaman that the Association should be represented on the Board of Governors of the Technical School, and Dr. Freeman advocated the foundation of a University College.

A lecture on "The Evolution of a Modern Tramway System" was delivered on February 24th by Mr. F. Bland, of Messrs. Edgar Allen, Ltd., to the members of the Society of Engineers and Metallurgists, at the Applied Science Department of Sheffield University.

The Electrification of Seeds.—In the House of Commons, recently, in reply to a question, the Secretary to the Board of Agriculture, Sir Arthur Boscawen, said the Board had arranged for experiments to test the claims put forward by those interested in commercial processes for the electrification of seeds. The experiments were being conducted at several centres, but, as they had not yet been completed, it was not possible to state what results would be obtained.—*Mark Lane Express.*

The I.E.E. Electrical Appointments Board.—Naturally, in view of the rapidity with which demobilisation is taking place, candidates for employment in civil occupations are coming forward in greater numbers than inquiries from employers, and the register of the Appointments Board shows a considerable want of balance. The claims of the engineers who have been fighting our battles to prior consideration need no emphasis, but we may suggest as an additional reason for employers to lodge inquiries the fact that those who come first will have the best opportunities of securing the pick of the list, and even if they are not quite ready to proceed with their after-war programmes at the moment, it will be to their advantage to get into touch with the most suitable men without delay. Communications should be addressed to the Secretary, Electrical Appointments Board, 1, Albemarle Street, W.1.

Parliamentary.—Bedwellty U.D.C. is making application to Parliament for powers to purchase the Rhymney Valley and General Electric Supply Co.'s undertaking, and to carry on the business of the company.

An Electrical Problem.—In a letter to the *Electrical World*, Prof. V. Karapetoff points out that for an aviator to determine away up in the clouds his speed with respect to terra firma, he must have something there that is invariable with respect to the ground, and about the only thing of this kind seems to be the earth's magnetic field. Imagine a long horizontal wire stretched across the aeroplane; an electromotive force will be induced in this wire by the vertical component of the earth's magnetic field, directly proportional to the velocity of the aeroplane. But in spite of the apparent simplicity of such an arrangement, it seems to be impossible to measure this E.M.F. by any known means. The two leads from the ends of the wire to the galvanometer will be cut by the same magnetic field in the opposite direction, and the total voltage registered by the instrument will be zero. Placing these leads in an iron pipe so as to shield them from the magnetic field would not remedy the matter in the least.

"Here is then an interesting practical problem and also an extremely important theoretical proposition about measuring the induced E.M.F. in a moving conductor when the measuring device itself is moving with the conductor."

We may remark that the device would be useless unless the aeroplane were moving steadily either horizontally or at some known angle with the horizontal plane; this could not be determined in a cloud, and therefore the "practical" aspect of the matter is of little moment. But the electrical problem is exceedingly interesting. It is somewhat analogous to the problem of measuring the mass of a body when the experimenter and his apparatus are falling freely under the action of gravitation: this can be done.

Fatality.—At Accrington, on Monday, Charles Knighton (64), a labourer at Messrs. Howard & Bullough's works, died whilst attending to the electric motors. He informed another employé that the switch of one of the motors would not act, at the same time pressing the handle out of gear. He then pushed the handle in the opposite direction, and at once fell to the ground, dead.

The International Electrotechnical Commission.—The Central Office of the I.E.C. has been maintained during the war through the generous assistance of the National Committees, with which it has been in direct communication, and is now considering the question of reorganisation of the whole Commission. In order to carry this into effect it will be necessary to have a plenary meeting of the Commission, when various important matters will be considered—such as the question of the enemy countries, which before the war took part in the work of the Commission, and that of filling the gaps which time and other circumstances have unfortunately made in the membership of the various Committees. In the question of nomenclature, for instance, it will be difficult to replace such a delegate as the late Dr. S. P. Thompson. With regard to the rating of electrical machinery, during the war Europe has not been able to devote much attention to research work, and consequently has not made so much progress in the study of insulating materials as the United States. Moreover, certain misunderstandings have arisen owing to the fact that the American and British Committees have, with the very best intentions, in certain cases slightly exceeded the limiting temperatures adopted by the I.E.C. This has given rise to misapprehension on the part of the French Committee, and it has been thought wise to arrange for a meeting of the Special Committee on Rating in Paris just after Easter, rather than wait for a full meeting of the Commission. In this way it is hoped that the difficulties will be surmounted and the foundations laid for a plenary meeting of the Commission. The Central Office is at present engaged in arranging the meeting of the Special Committee, which consists of representatives of Belgium, France, Great Britain, Italy, Sweden, Switzerland, and the United States of America.

The question of graphical symbols in electrotechnics has been under discussion in America, Great Britain, and Italy, and a large amount of preparatory work will be at the disposal of the Special Committee on Symbols.

It is probable that an international standard for the resistance of aluminium will be adopted, in the same way as has been done for copper. The French Committee is also suggesting that the I.E.C. should take up the question of screw lamp sockets and holders. It is becoming more and more important in all international work that a clear-cut distinction be made between standards and detailed specifications.

Manchester Strikes.—Apparently the strike of electricians in the Manchester district was partly based upon a misunderstanding, the employers not having been aware that the apprenticeship demand had been dropped by the Electrical Trades Union, leaving only the minimum wages question for settlement. The members of the Union are balloting on the question of a general strike in the district in support of the men who are out.

The strike at Messrs. Crossley Motors, Ltd., Gorton, ended last Sunday, when the men decided to resume work on Monday. The strike did not receive official Trade Union recognition. About 3,500 men were concerned in it, and of these 2,000 had returned to work last week.

Copper Prices.—Messrs. James & Shakespeare report March 5th :—Copper bars (best selected), sheets and rods, £118.

Messrs. F. Smith & Co. report March 5th :—Electrolytic bars, £81; electrolytic sheets, no change; electrolytic wire rods, £91; ditto H.C. wire, 11¼d.; silicium bronze wire, 1s. 3½d.

French Company.—La Société des Accumulateurs Fixes et de Traction is the name of a new company which has lately been formed at Romainville, with a capital of £40,000.

Scientific Management.—The demand of Labour for shorter hours and higher wages can be complied with if the workers will abandon restrictions on output; to secure the necessary increased rate of production, however, this alone will not suffice—we must have in all industries greater efficiency, based not so much on individual effort as on scientific management. America has led the way in this respect, and the astonishing results obtained by English firms who have adopted these methods should be more widely known. The Industrial Reconstruction Council has taken up the matter, and at a public meeting held at the Institute of Journalists on Thursday last week, it elected a sub-Committee to arrange a series of fortnightly conferences, which would deal with this subject in all its bearings. Further particulars may be obtained from the Organising Secretary, I.R.C., 2 and 4, Tudor Street, E.C. 4.

Strike Prosecutions.—Referring to the paragraph under this heading in our last issue, Mr. W. T. Weeks writes stating that he and other members of the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers were not on strike, neither had they any intention of supporting the strike; it was owing to their continuing at work that the trouble arose. Mr. Godfrey, he says, walked into their station and called them blacklegs. We regret that an injustice has inadvertently been done to Mr. Weeks and his fellow-Unionists.

The Wage Problem in Industry.—On Wednesday, last week, Mr. W. L. Hichens, chairman of Cammell, Laird & Co., Ltd., delivered a very timely paper before the Royal Society of Arts, in London. There was a sparse attendance—too sparse altogether for the consideration of a paper on such a subject from a man of great industrial reputation, whose sympathies have long been favourable to better conditions of living for the industrial classes. There should have been a far larger audience and a more worthy discussion. Sir G. R. Askwith, K.C., presided, and, referring to the movement among the workers of the country, said the demand was that the results of production should be distributed more equitably. Mr. E. W. Mundy (secretary of the Labour Co-partnership Association), and Mr. Neville Priestley, spoke in defence or support of the co-partnership principle, but the author did not see that co-partnership went to the root of the matter. He agreed with the chairman that the distribution of wealth was the main problem with which the country had to deal, but how was improved distribution to be brought about? Was it to be brought about by a free fight between one section of the community and another, or by some reasoned method? The Government would eventually have to face the responsibility for determining the relative distribution of wealth as between one section of the community and another. The questions now confronting us should not be determined by brute force, but by some kind of impartially-constituted tribunal, and unless public opinion could be educated up to that point the country would remain in the quagmire in which it found itself to-day.

Appointments Vacant.—Two electricians for the Sheffield Corporation Waterworks; overhead wireman for the Ramsbottom U.D.C. Traction Department; meter tester for the Greenock Corporation Electricity Department. The Municipal Tramways Association is inviting applications until March 24th for the appointment of general secretary at not less than £750 per annum. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Highways Committee of the L.C.C. recommends that Mr. J. TERRY, district traffic superintendent (southern section) in the Council's tramways department, be appointed to act temporarily as traffic operation superintendent, with an acting allowance of £100 a year, in addition to his salary of £350, and that Mr. S. R. GEARY, an assistant in the tramways department, be promoted to be a divisional superintendent in the traffic branch at £300 a year, rising to £400.

The staff and workmen at the Swansea Corporation electricity station have presented a silver cigarette case, suitably inscribed, to Mr. F. J. BURGESS, the chief engineer, and a pair of silver vases and fruit-stand to Mrs. Burgess. Mr. Burgess is leaving Swansea, after four years' service, to take an active interest in the firm of Messrs. Burgess and Sons, of Exeter. The borough electrical engineer (Mr. J. W. Burr) presided.

The Hull Corporation Tramways Committee has increased the salary of the tramways manager from £600 to £800 per annum.

Dover T.C. has decided on the following additions to salaries:—Mr. R. C. Harper, borough electrical engineer, to be given a war bonus of £130 from January 1st; Mr. E. W. Smith, works superintendent, a war bonus of £65; Mr. H. E. Osborne, mains engineer, war bonus of £52; Mr. E. H. Bond, tramways general manager, war bonus of £25.

Mr. W. CLOUGH, who recently retired from the management of the Bury tramways department, was last week presented by the chief officials with a silver tea service as a mark of appreciation of his services with the Corporation for 26 years.

Southport Tramways Committee has appointed Mr. E. SIDGWICK, of Rochdale, depôt superintendent at £250 a year.

Mr. C. WATMOUGH, late A.I.D., has been appointed engineer and secretary to the Ingleton Electric Lighting and Power Co., Ltd.

On Saturday, at the electric light works, East Street, Grantham, the staff and workpeople gave a "send off" to the manager, Mr. J. E. EDMUNDSON, and presented him with a silver fountain-pen and wallet. Mr. J. Jenkinson made the presentation. Mr. Edmundson, in responding, remarked that health reasons had led him to decide to leave. In a brief allusion to the labour unrest, he said if Capital and Labour worked together that would help to solve many of the problems now engaging the industrial community. If the men had a grievance at any time, he advised them not to harbour it, but to get it off their chests. Mr. Edmundson left Grantham on Monday, and Mr. F. H. Brandreth, of Stamford, takes up his duties as manager this week.

General.—Sir OLIVER LODGE has announced his intention to retire from the Principalship of the Birmingham University at the end of July, in order to make room for a younger man to enter upon his duties with the period of reconstruction. Sir Oliver proposes to devote the remainder of his life to the problem of the Ether of Space.

Mr. PERCY B. SMITH has been demobilised from the R.A.F. after more than three years' service, and has resumed his position as representative of Messrs. Home & Rowland, electrical engineers, of Charlton, London, S.E. 7.

The *Industrial Australian and Mining Standard* states that Messrs. B. WOODFULL, S. G. HALL, and A. H. STONE, engineer assistants in the electric supply department of the Melbourne City Council, who are at present on active service, have been appointed to take advantage of the travelling scholarships established by the Council in 1916. They will spend a year with some leading manufacturer in England. The Council will grant them £50—to cover their return fare, and £1 per week to supplement their earnings while abroad. Those enjoying the privileges of the scholarships undertake to return to the employ of the Council at the end of the term.

The daily Press states that Sir MAURICE FITZMAURICE has retired from the post of Chairman of the Canal Control Committee, and the President of the Board of Trade has appointed Mr. Sydney Preston to succeed him.

Mr. JOHN LEE, postmaster of Belfast, has been appointed Controller of the Central Telegraph Office, London.

Mr. H. M. PEASE, who has for a number of years carried out the duties of assistant manager and sales manager of the Western Electric Co., Ltd., of North Woolwich, has now been appointed managing director.

Mr. C. J. FOX, who has been connected with the British Westinghouse Co., Ltd., for 15 years (nine years as selling engineer in Nottingham and district, and latterly in the Lancashire area), has resigned to take up the position of managing director of Messrs. W. J. Furse & Co. (Manchester), Ltd., electrical and mechanical engineers, 18, Corporation Street, Manchester.

Roll of Honour.—Sergeant D. H. CREEARS, who has died of pneumonia at Charleroi, was employed at the Accrington Corporation electricity works.

Obituary.—MR. A. C. REYROLLE.—The death occurred in Newcastle-on-Tyne, on February 27th, of Mr. A. C. Reyrolle, the managing director of Messrs. A. Reyrolle & Co., Hebburn-on-Tyne. Mr. Reyrolle was a native of Corrèze, France, and was born in 1864. He came to London in his 19th year, and went as an "improver" to Messrs. Lége & Co., scientific instrument makers. In 1886 he opened a workshop in Charlotte Street, where electrical work was carried on, and in 1897 he opened a factory in Pancras Street, Tottenham Court Road. In 1901 he commenced the Hebburn business, and afterwards closed the London works in order to give full attention to the Tyneside business. The manufacture of switchgear is a speciality with the firm, and in this direction, and others, the business has steadily grown until the firm now employs 700 hands, and stands in the foremost rank of switchgear manufacturers. Mr. Reyrolle always took a great interest in his employés, and he recently organised a practical school for the apprentices. He was a member of the Hotspur Lodge of Freemasons. Mr. Reyrolle leaves a widow and a son to mourn his death. The funeral took place on Monday at Elswick Cemetery, in the presence of hundreds of friends and employés.

MR. H. T. BYFORD.—The *Times* "Deaths" Column records the death at Liverpool of Mr. Henry Talbot Byford, A.M.I.E.E.

ALD. J. HEALD.—We regret to state that Ald. James Heald, chairman of the Lancaster Electricity Committee, died on February 27th from septic pneumonia, at the age of 68 years. Mr. Heald served his apprenticeship at Preston as a plumber, and afterwards started business at Lancaster, ultimately adding electrical engineering to it. He had been a member of the Corporation since 1894.

MR. B. DAVISSON.—Messrs. C. A. Vandervell & Co., Ltd., received news of the death of Mr. Bertram Davisson, who was manager of their Manchester depôt before the war. Mr. Davisson joined the Army in 1914 in the Legion of Frontiersmen, and was attached to the Belgian Army. When the

Legion was disbanded he went into the R.G.A., and was out in France till the Armistice was signed. He was practically demobilised, and was about to resume his duties with the firm, when he was seized with influenza, and, pneumonia supervening, he passed away on Saturday last. His age was 31.

Lieut. E. Atherton, M.C.—Lieut. E. Atherton, M.C., who has died in hospital of pneumonia, was on the staff of the British Engine, Boiler & Electrical Insurance Co., Ltd., Manchester.

Mr. H. Bibby.—The death has occurred suddenly, on February 25th, of Mr. Harry Bibby, electrical engineer, of Bold Street, Warrington, aged 34 years.

REVIEWS.

Elementary Mathematics and their Application to Wireless Telegraphy. By S. J. Willis. London: The Wireless Press, Ltd. Pp. 182; 120 figs. Price 3s. 6d. net.

This book of 182 pages, with 120 illustrations, is mainly aimed to meet the needs of that numerous class of capable wireless students of average or fair education who are not conversant with more advanced mathematics. The contents relate mainly to logarithms, geometry, algebra, trigonometry, and vector methods, together with a chapter on the various uses of squared paper for plotting curves. The subjects are not, of course, treated in any approach to a comprehensive manner, but are practically a digest of the portions more especially useful in the solution of wireless formulæ and calculations. Examples of the application of the methods are given in each chapter, but rather few of these treat specifically electrical matters. The value of the book might, it is considered, be enhanced by a greater proportion of the examples being selected from actual wireless problems. The book should prove a useful incentive to wireless students of good mathematical ability and will also, no doubt, be popular among practical men, who, though having an acquaintance with more advanced mathematics, do not keep sufficiently in touch to make full use of its advantages. To the former it should prove a useful "stepping stone" to the closer study of higher mathematics, while to the latter it will serve as a memory jogger and time saver.

The Manufacture of Aluminium. By J. T. Pattison, F.C.S. 1918. Pp. viii + 104; 18 figs. London: E. & F. N. Spon, Ltd. Price 7s. 6d. net.

The manufacture of aluminium in the very nature of things is bound to be more or less of a monopoly in every country fortunate enough to have water-power that can be used for this purpose. Monopoly of effort usually implies monopoly of knowledge, and the electrolytic production of aluminium is no exception to this sad rule. Hence Mr. Pattison is unable to give us here anything more than an "Historical Survey of Processes" in the key chapter of his book, the nature of which is more accurately described by the sub-title—*With Full Notes on Aluminium Alloys, the Analysis and Examination of Aluminium Works Materials, and the Manufacture of Carbon Electrodes.*

From Chapter III onwards, in which the author presents his account of these subsidiary matters, beginning with the last, there is a great deal of extremely useful and interesting information not readily, if at all, available elsewhere, and we are glad Mr. Pattison has thought fit to collect and publish it. These remarks apply more particularly to Chapter VIII. on "The Analysis and Examination of Aluminium Works Materials," which include the greater part of the little book, and which will be found undoubtedly useful to the works chemist. Since the publication of the book a somewhat revolutionary method of aluminium analysis has been described before the Faraday Society by Mr. John Rhodin. It was subject at the time to some severe criticism at the hands of the "orthodox" aluminium chemists, but by the pragmatic test it would appear to have justified itself.

The Applications of Electrolysis in Chemical Industry. By Arthur J. Hall, B.Sc., F.I.C. 1918. Pp. ix + 146; 58 figs. London: Longmans, Green & Co. Price 7s. 6d. net.

This is one of the series of monographs on industrial chemistry, which is being issued under the general editorship of Sir Edward Thorpe. While it was no doubt wise to include a volume on industrial electrochemistry for the sake of completeness, it cannot be said that this book gives us anything that has not already been published in book form. Moreover, the descriptions of processes seem to us to be too slight in most cases to be of practical use, while in many branches of the subject, for example, the electrolytic production of hydrogen and oxygen, where there has been notable advance during the past few years, the author has contented himself with presenting hardly more than an historical survey. We have never understood why it is considered necessary to begin books on electrochemistry with a chapter on "Methods of generating the current." In this instance it seems to be the editor and not the author who is responsible for the idea. To the designer of the generators used in electrolytic processes the information given is obviously useless, while the general student will surely have acquired in other ways the elementary principles of the dynamo. It would have been more useful to occupy the space so utilised with a much fuller discussion of the question of power centres and power costs than the author has allowed himself.

In the chapter on "Electrolytic Refining of Metals," ground is covered that is mostly familiar. Much recent work that has been done in iron refining is not referred to at all. On the other hand, many processes are given, *e.g.*, the Hoepfner process for copper extraction (described in the next chapter, on "The Electrolytic Winning of Metals") which are no longer in use. This fact should be stated. The best chapters in the book are those on "Electrolysis of Alkali Chlorides" and "Hypochlorites, Chlorates, Perchlorates," but these too, suffer from the faults already indicated, and they are undeniably "thin." Two short chapters on the "Production of Inorganic and Organic Compounds" bring the book to a close. In the case of the latter substances the author excuses his brief treatment by reference to Dr. Löb's well-known treatise. But why, then, have written the book at all? A bibliography would have served the purpose!

NEW COMPANIES REGISTERED.

Trolleybus, Ltd. (153,352).—Private company. Registered February 24th. Capital, £100 in £1 shares. As title. The subscribers (each with one share) are:—G. Reader, 35, Coleman Street, E.C., solicitor; W. A. Chadwick, 35, Coleman Street, E.C., solicitor. Table "A" mainly applies. Solicitors: G. Reader & Co., 35, Coleman Street, E.C.

E. Pearson & Sons, Ltd. (153,407).—Private company. Registered February 27th. Capital, £4,000 in £1 shares. Electric and sanitary engineers, &c. The subscribers (each with one share) are:—G. E. Pearson, Nethercape House, Farsley, electrical engineer; F. Laycock, 62, Beech Grove, Lidget Green, Bradford, solicitor's managing clerk. Subscribers appoint the directors. Registered office: Nethercape, Farsley, Yorks.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rangoon Electric Tramway Supply Co., Ltd.—Satisfaction to the extent of £7,507 on February 20th, 1918, and to the extent of £7,655 on February 19th, 1919, of debenture stock dated 1906-13, securing £250,000.

Electrical Distribution of Yorkshire, Ltd.—Mortgage on the undertakings of the company authorised by various provisional orders, and its general assets, present and future, dated February 11th, 1919, to secure all moneys due or to become due from company to Barclay's Bank.

CITY NOTES.

Liverpool Overhead Railway Co.

Mr. H. C. Woodward, presiding at the annual meeting on February 25th, referred to industrial unrest, and said that constant disputes and unreasonable demands could only lead to unemployment on a vast scale by preventing enterprise in the shape of new undertakings, and by driving capital out of the country. The traffic of the railway in 1918, after a slight decline in the number of passengers carried in 1917, had again soared upwards. The increase in first and third-class traffic was equivalent to 58 per cent. and 30 per cent. respectively, and the workmen's traffic had increased 19 per cent. The marked increase of traffic had been swallowed up by much heavier expenses, both in labour and materials, and by payments to the Government under the original agreement. The consequence was that they could only repeat the dividends of the previous three years. The year's total expenditure on the railway and tramway was £108,834, an increase of £23,428, due to higher cost of coal, &c. For the increase in workmen's traffic they had added two third-class coaches, but as that traffic was continually growing, the congestion was not diminished to any great extent. The limited length of platforms and small shed accommodation would, they feared, prevent further improvements in that direction. The greatly enlarged traffic and its safe conduct had been a source of anxiety. Their traffic still went on increasing.

Telegraph Construction and Maintenance Co., Ltd.

The annual meeting was held on February 27th, at 38, Old Broad Street, E.C. The Earl of Selborne, K.G., who presided, said that their work had continued of the same character as in the previous year—work which might accurately be called national work at high pressure. He congratulated the shareholders on another year's successful working. Their contracts for munitions of war, of course, stopped last November. The last part of the year had been a broken period

in which they had been endeavouring to get back to their old work again. During the war they had manufactured 20,000 miles of trench telephone cable, mostly with several conductors; they had also made 19,000 miles of submarine cable, and their ships had been actively employed, generally on most dangerous work, laying, repairing, and diverting cables. The *Telconia* had made 75 repairs to cables, and laid 24 new ones around the English and Irish coasts; both that vessel and the *Colonia* had several times been in close proximity to German submarines, but, thanks to the efficient protection given by the Admiralty, both ships had come through without loss. In addition to that, they had done a good deal of their ordinary work for the maintenance of the cables of the English and other submarine telegraph companies. Their engineering shops had also been fully employed in making munitions of war. All that work had involved running their factories at high pressure and working long hours throughout the war, and their turnover had been larger than it had been for some years. They had only had to pay excess profits tax in one year, and then but a small amount, and last year, owing to the break in their contracts, their profits were slightly reduced, and therefore there would be some return on that account, which would probably leave them all square over the whole period. That was very satisfactory to them, as it had been their policy all through the war to execute all their contracts upon as small a margin of profit as possible, and although they had carried out an enormous amount of work of vital importance they had only made sufficient profit to enable them to maintain their usual dividend. The accounts showed much the same results as they had done for some years. The £140,000 4 per cent. debentures were paid off on January 1st last. The directors decided upon that course, as it would not have been possible to renew the debentures in the present state of the money market without considerably increasing the rate of interest, and the liquid resources of the company permitted of the redemption. The board had had under consideration the question of issuing fully-paid shares in respect of reserves created in the past which were not now needed, and the time seemed opportune once the debentures had been paid off. They therefore decided to ask the shareholders to authorise certain alterations in the Articles of Association which were necessary for that purpose. It must be obvious to them that the present nominal capital of the company was small for the magnitude of the work carried on, and that although they had been paying 20 per cent. for some years upon that nominal capital, the rate of profit which they made upon the actual capital employed was much less. It was, therefore, proposed to double the share capital, and to issue to the shareholders one new fully-paid-up ordinary share for each share held. If that was carried out, the shareholders would have two shares for every one they now held, but as that would not bring any new money into the business, but only capitalise funds already being used, they must not expect to receive any larger cash dividend upon their total holding. Although they had ceased to make munitions of war they were still a controlled company, and had to act entirely on Government instructions in all matters concerning the wages paid to their employés and the hours of work. Their relations with their workpeople had been generally satisfactory throughout the period of the war, and continued to be so. They had plenty of work in hand, and would be glad if they could get on with it quicker, but the difficulties of obtaining material were still considerable. Referring to the labour unrest, his lordship said there were Bolshevists in this country, but there were very few of them, and, in his view, no greater injustice could be done than to confuse for one moment the industrial movement which was causing them so much anxiety with the Bolshevism that prevailed on the Continent. The movement which was now going on here was really mainly one for the improvement of status, and they must always carefully bear in mind that the vast majority of the men who were making these demands were men who had stood absolutely by their side either in the trenches, the coal pits, on the railways, or in the shops, during the whole of the war. Even when the situation seemed most difficult, that, he was sure, was the moment when they should weigh everything the men put forward with the utmost calmness and freedom from passion, and throughout try to bring to bear upon the whole consideration of those vast problems that kindliness which St. Paul told them was the foundation of righteousness.

The report was adopted. Subsequently a special resolution was passed altering certain of the Articles of Association in order to enable the directors to increase the share capital as outlined by the chairman.

Indo-European Telegraph Co., Ltd.

It has now been possible to issue the accounts for 1917. The report says that the interruption of the company's through communications continues, and telegraphic receipts have been limited to traffic over the eastern sections of the company's system. Various parts of the company's line in Russia were isolated or damaged, but they have for the most part been restored. Definite proposals for the re-establishment of the company's route are now before the authorities. The total distribution in dividends for 1917 was brought up to the same level as in previous years by drawing upon the equalisation of dividends fund. Revenue was £123,892, as against £162,274 for 1916 (decrease £38,382). The expenses were £80,778, against £75,329 for 1916 (increase £5,449). The balance, including £10,323 brought forward, is £32,859, and after deducting the interim dividend, it is £22,234, to which is added £25,000 transferred from equalisation of dividends fund. After deducting the final dividend 22s. 6d. per share, making with the interim dividend 7 per cent. for the year, and distributing 30s. per share from the equalisation fund, making a total of £3 5s. per share, free of tax, £3,109 is carried forward to 1918.

Electrical Distribution of Yorkshire, Ltd.

Mr. R. W. Wickham, presiding at the annual meeting in Leeds, said that the prospects for 1919 were brighter than those for 1918. The cessation of hostilities, by permitting labour and material to be released, enabled the board to make extensions of the company's mains which had long been desirable, but had of necessity been deferred. Many demands for supply were now being made, and the revenue from these new consumers and from an unrestricted use of electricity by old consumers, combined with the increased charges, would, it was hoped, help to the resumption of that steady expansion of business which had been a feature of the company's trading in past years. The extensions of mains would require additional capital, and an opportunity would be afforded to the shareholders to take up a balance of 4,366 ordinary shares, and so bring up the total number of shares issued to 50,000. In eight of the districts covered by orders held by the company they were unable to proceed with the construction of works until a date to be fixed by the Board of Trade after peace had been declared, but in the remaining districts they proposed to make extensions as early as labour and materials made it possible. This work would require a considerable amount of capital, and a further issue would be made as the restrictions of the Government were relaxed.

St. James' and Pall Mall Electric Light Co., Ltd.

Mr. W. Leaf, presiding at the annual meeting at Carnaby Street, on February 25th, said that they had had to face drastic restrictions which had materially reduced their output, and had had to meet increased labour and other expenses. The advance of 10 per cent. in charges for current had not met the loss due to increased costs. The output had been reduced from 15,643,000 units to 13,942,000, and the total revenue from sale of current produced only £152,136, against £153,648 for 1917. In spite of the reduction in the net profits they had not hesitated to recommend an increased dividend (10 per cent., against 9 per cent.). Last year the outlook in February was in many ways most disquieting, alike for the electrical industry and for the nation at large, and they felt it their duty to advise a most conservative treatment of the profits. To-day circumstances were very different. They had heavy enough problems before them, but they were meeting in the hour of victory. They were girding themselves for the new tasks in a spirit of hopefulness and courage, and thought it right that some small reward for the self-denial of last year might fairly be claimed. They had restored their contingency fund to the highest point it had ever reached, and they did not think there was any need at the moment to make it higher. Their depreciation fund was based on most prudent calculations. Ten per cent. was no more than a fair return on the capital invested, under strict limitations as to term and uncertain conditions of repayment 12 years hence. It was clear that in the reconstruction period there would be an immense increase in the demand for electrical energy. They had made their plans to meet this demand by an increase of £53,886 in the capital expenditure of the Central Co. It had been spent mainly in the purchase of further land for the extension of Grove Road station and in the paying for the new 6,000-kw. turbo generator which was completed last August. This set, coupled with the new boilers put in in 1917, had resulted in a very marked reduction in coal consumption at a time when prices were steadily increasing. The speaker continued: "Despite the serious fall in our output, due to the restrictions to which I have already referred, the relative quantity of coal burnt at the Grove Road works has been reduced by no less than 6 per cent., or about 2,500 tons, and our running costs for coal now rank with those of the most economical stations in the country, bearing in mind the distance of London from the coalfields. This economy in generation has led to a continuous growth in the proportion of our output which is supplied to us by the Central Co. In 1916 the Central Station generated about 20 times as much current as our own stations. In 1917 this proportion had grown to 30 times, and last year it had further developed to about 40 times. In other words, the Central Station is now responsible for over 97 per cent. of our total output. We are thus making every use of the advantage of production on the large scale." They were already setting to work on the erection of new buildings at Grove Road power station. It was their intention to keep that station up to date in every respect, so that whatever happened, when the day of purchase came, they might have a valid claim for a full price for a plant of the first rank. Referring to the new Government Bill relating to electric supply, concerning the draft of which they were in complete ignorance, the speaker said: "If Parliament decides upon a general consolidation our policy will be to assist, taking at the same time a very determined attitude in defence of the right to full compensation to which you are entitled as proprietors of this undertaking. The London companies are in

constant conference over the very difficult task of determining exactly what are the terms which we shall be prepared to require if it is decided that we are to be expropriated; and we are further considering whether it will be possible to put forward some joint scheme under which we may be permitted to co-operate in the future supply of London. More than that it is impossible for me to say till we know something of the Government proposal." After referring to the excellent relations that existed between the company and its employés, the chairman paid a tribute to the services rendered by the managing director, Mr. Walker, who, during the past few weeks, acting in conjunction with Mr. C. P. Sparks and Mr. Frank Bailey, had represented the London electrical undertakings in all negotiations with the Government, and had saved the situation.

Westminster Electric Supply Corpn., Ltd.

Lord Downham of Fulham, presiding at the annual meeting, on February 26th, referred to the effect that rationing of electricity had upon their operations. Just as they had succeeded in inducing a large number of their consumers to adopt electric heating, the apparatus hired out to them were returned owing to what practically amounted to a prohibition of their use. Connections to the premises of new private consumers also ceased entirely, although that setback was, fortunately, somewhat mitigated by their being called upon to supply many temporary buildings erected in their area of supply for war purposes. To meet the increased cost of production, due to coal prices and higher salaries and wages, they had raised their prices but had not thrown the additions entirely on to consumers. During 1918 they had expended on war bonuses and advances £18,000, or equal to a 3 per cent. dividend. Preparations had to be made for a considerable increase in output. To provide for this, for repayment of debentures, and for general purposes, they had invited shareholders to take up 50,000 additional ordinary shares. The result was entirely satisfactory. There were some shares left over, and out of these they would reserve to the staff a certain number on exceptionally favourable terms as to deferred payment of instalments. After referring briefly to the Government electricity scheme and to the recent industrial troubles, the chairman, in conclusion, said that they who owned, either individually or collectively, or controlled and directed the industrial and commercial undertakings of the nation should be at least as careful of the interests and welfare of those who made the profits as of those who shared them. In these disturbed and restless days it behoved everyone to put his house in order.

Notting Hill Electric Lighting Co., Ltd.

Capital expended during 1918, £941. The lamps connected (30-watt) increased from 252,307 to 259,074. The profit for 1918 was £20,016, against £24,270 for 1917. The consumers, 4,637, are all, excepting 18, supplied at 200 volts. There is put to depreciation, renewal and reserve £3,000; debenture interest absorbs £1,856; Kensington and Notting Hill joint debenture stock charges require £3,962; income-tax £5,617. Both classes of 6 per cent. preference shares have received their full dividend, and £1,340 remains to be carried forward. The reduction in the balance available for dividend from £11,279 to £7,496 will not permit any dividend being paid on the ordinary shares. [It may be added that there are 27,050 ordinary shares of 1s. each.—Editors.] The report adds:—

> The unsatisfactory result of the year's working is due mainly to the increase in the working charges, especially in the cost of labour. The war bonus ordered by the Government now amounts to 28s. 6d. per man, plus 12½ per cent. on all earnings. This was to some extent compensated for by the increase in the charge for current up to the maximum of 8d. per unit, but the Fuel and Lighting Order which came into force in October caused a drop in consumption of about 30 per cent. during the last quarter of the year.

Units generated or purchased, 3,224,629; units sold, 2,308,797. Used on works, 12,200; expended in distribution, &c., 908,632. Annual meeting: March 11th.

Tyneside Tramways & Tramroads Co.—Presiding at the half-yearly meeting, Dr. J. T. Merz said there was a gross increase in the receipts of £9,500, but as against this there was an increase of £8,500 in the costs, owing to the higher prices of materials, wages, and current. They had placed certain sums to special reserve, and an outstanding feature was that they had increased the investments to £38,600, which was £9,500 more than in the year before. They aimed at increasing their reserve, because all the money they had would be wanted presently for relaying some parts of the line, and repairs to rolling stock, although the latter had been kept up in as good a condition as possible during the war period. They expected to get a full report of what was required upon the lines and rolling stock from their engineer, Col. McClellan, who had been with the Army for nearly five years.

Charing Cross, West End & City Electricity Co., Ltd.—Dividend of 4 per cent. for the year 1918 on the ordinary share capital of the West-End undertakings of the company.

Tyneside Electrical Development Co., Ltd.—Dividends at the rate of 6 per cent. on the preferred ordinary and 10 per cent. on the deferred ordinary shares, putting £1,000 to reserve, and carrying £815 forward.

Metropolitan Electric Supply Co., Ltd.—The report shows that the capital expenditure increased by £25,267 during 1918. Gross revenue for the year £348,726 (increase £30,280). Working expenses £208,112 (increase £23,569). Balance at credit of revenue before providing for depreciation £140,614. Added to depreciation and reserve £50,000, making it £477,359. To credit of net revenue £90,614, plus balance brought forward, and interest on investments, making £109,130. Interest on debenture stocks, &c., and preference dividend having been paid, the total distribution on the ordinary shares is 5 per cent. for the year, and £4,836 remains to carry forward. New connections 1,611 kw., making the total 42,559 kw.

South Metropolitan Electric Light & Power Co., Ltd.—Mr. H. St. John Winkworth presided, on February 26th, at the annual meeting. He said that there was little doubt that the Government restrictions on new business would in the near future be withdrawn, and the development of the company's business be allowed to proceed unhampered. They had increased the amount put to depreciation and the carry forward. It was advisable to strengthen their position in view of the uncertainty of the times. The prospects for the current year were very uncertain. An improvement was being shown each week in the new orders received, but they must expect a falling off in revenue from war factories. After the change over to peace work had been effected, they would experience steady and continuous improvement.

Tramways, Light & Power Co., Ltd.—Viscount Chilston, at the annual meeting, said that the year had been one of greatest anxiety to all connected with the company's affairs. Notwithstanding all their difficulties, the accounts were satisfactory. The income received from their various undertakings was £45,509, as against £42,215 in the previous year. They proposed to make a further substantial addition to reserve out of the year's profits. If labour demands recurred, as there was every possibility that they would, some legislation must be enacted by which tramway companies were permitted to charge increased tolls. They were watching the matter very carefully, and would give cordial support to any action taken in that direction.

Newcastle & District Electric Lighting Co., Ltd.—The net profit for 1918, after charging debenture and loan interest and allowing for depreciation, is £8,321, plus £13,257 brought forward. Dividend 4 per cent., less tax, for the year, carrying forward £13,099. A further £3,400 of the 6 per cent. second mortgage debentures has been redeemed. The amount at the credit of reserve for depreciation and renewals £50,000, and in addition £16,000 allowed for the year, have been written off plant and machinery, &c. Mr. W. D. Hunter has resigned the position of managing director and engineer, but remains as a director. Mr. N. S. Tennant has been appointed general manager and engineer.

Kalgoorlie Electric Power & Lighting Corporation, Ltd.—Owing to mail delays from Australia the meeting cannot be held before June, but in a circular letter just issued the company states that the disorganisation caused by the war has continued, and costs all round have again been higher. Expenses were further added to by a breakdown of a portion of the plant during August, the repairs to which have been costly, and have only recently been completed. Due to various causes, including a decreased demand for current, the profit made during the year, after making the necessary provision for debenture interest and redemption, will not permit of the payment of a dividend to the holders of the preference shares in April next. The usual full statement of the position will be published later.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—During 1918 the number of houses and shops connected increased by 63 to 5,173, and the devices of 30-watts consumption by 14,991 to 572,615 (17,178 kw.). Units sold: 4,580,854. Net profit £11,763, plus £580 brought forward. After paying the first and second preference dividends, and a total of 6 per cent. for the year on the ordinary shares, £543 is to be carried forward. Sir H. W. Bliss has retired from the board. Mr. F. J. Walker, "who has been associated with the electricity supply industry from its earliest years," has been elected in his place. Annual meeting: March 20th.

Electro-Bleach & By-Products, Ltd.—Excess profits duty for 1918 not having been ascertained, the accounts for that year cannot yet be submitted. Satisfactory progress has been made, but it is not likely that the directors will recommend further dividends for 1918 beyond those now announced, namely: further interim dividends of 3½ per cent., less tax, on the preference shares, making 7 per cent., and of 12½ per cent., less tax, on the ordinary.

Clarke, Chapman & Co., Ltd.—Net profit after providing for debenture interest, repairs, &c., £170,801. An interim dividend of 2s. per share has already been paid on the ordinary shares, and a final dividend of 3s. per share, less tax, is now announced. £89,623 is carried forward, subject to excess profits duty for 1918.

Northallerton Electric Light & Power Co., Ltd.—Net profit of £342, as compared with £249 for 1917.

Shropshire, Worcestershire & Staffordshire Electric Power Co.—A general meeting is to be held on March 10th to consider a resolution converting the 150,000 unissued ordinary shares into preference shares, entitled to a cumulative dividend of 6 per cent., payable on March 31st and September 30th, and to priority for capital over the ordinary shares without further participation.—*Financier.*

Barcelona Traction, Light & Power Co.—The "Financier" states that an issue of 30,000 6 per cent. debentures of 500 pesetas (£20) each has been made by the above company, and has been taken firm by a syndicate of Spanish bankers at the price of 98 per cent.

Jarrow & District Electric Traction Co., Ltd.—Total revenue for 1918 £15,597, an increase of £4,814. After paying expenses, debenture interest, providing for renewals, putting £900 to reserve, and paying a dividend at 6 per cent. on the ordinary shares, £2,832 is to be carried forward.

County of London Electric Supply Co., Ltd.—Final dividend on ordinary shares at the rate of 9 per cent. per annum, less tax, making 7 per cent. for the year. £50,000 has been placed to reserve for depreciation, and £15,000 to special reserve for deferred maintenance. £15,500 carried forward.

Canadian General Electric Co., Ltd.—Quarterly dividend 2 per cent. on the common stock, and a half-yearly dividend of 3½ per cent. for six months on the 7 per cent. preference stock.

City of Oxford Electric Tramways, Ltd.—For 1918 the profit amounted to £10,454. Dividend 4 per cent.

STOCKS AND SHARES.

TUESDAY EVENING.

RUBBER shares have resumed a prominent place in Stock Exchange activity—not from any new conditions making for the industry's prosperity, but from the fact that the speculative investor throughout the country demands another outlet for the money now that the oil excitement has subsided. Apart from the rubber animation there is not a great deal doing in stock markets. The mystery of the national outgoings being so comparatively little less in armistice than in war days has a depressing effect upon gilt-edged securities, the holders of which are talking of a bad Budget—bad from the taxpayer's viewpoint. Reconstruction work of all kinds at home is hampered, mainly by the labour uncertainties, and partly by the vagaries of the New Issues Committee.

Home Rails have slipped further down what seems to be their permanent way of gentle melancholy. Steam stocks are depressed. Dulness is apparent in Metropolitans and Districts. Underground Electric income bonds at 93 xd. have gained ½ on balance. Taking the dividend at 6 per cent., the yield at this price would be 1s. short of 6½ per cent. on the money. Several of the prior-charge stocks are a little lower, which is not a tranquilising fact to those who looked for these issues to improve the nearer nationalisation came.

The burst of buoyancy that carried up prices of Mexican stocks has soon subsided, although the reaction did not rob the markets of all the strength they drew from the appointment of influential committees for protection of outside capital invested in the country. Another report published during the past few days has underlined the arguments advanced here as to the vital necessity of more money being raised for the purposes of reorganisation. The first step in rehabilitating Mexico will be the provision of an American loan to the Government of the country. There is plenty of money, we make bold to say, ready to leave Great Britain for Mexican undertakings were it permitted to go, and were satisfactory evidence offered as to internal peace having been restored in Mexico. It will certainly be some time before permission is given for British capital to emigrate, and other financiers will have matters much their own way unless the various protection committees take vigorous steps to justify their existence.

The Metropolitan Electric Supply Co. has done well, and raises its dividend from 4 per cent. to 5 per cent. The net revenue shows an increase of over £6,000, and the carry-forward of £4,800 is a trifle under the amount similarly dealt with last year. The shares have risen 5s. to 3½. The County of London Electric Co. declares a dividend at the rate of 5 per cent., making 7 per cent. for the year, the same as that for 1917. Prices in this section are well maintained. Westminsters at 6½ have recovered the dividend of 4s. a share deducted last week. St. James's at 7½ xd. are nominally 5s. lower, but the dividend was 6s. 6d. per share. The Notting Hill Co. is paying nothing on its ordinary shares, which last year received 3s. per share. The price is about 32s. 6d.

In the telegraph market the feature continues to be the demand for those stocks and shares upon which dividends are paid free of tax. Eastern Ordinary has improved to 160½, Cuba Submarines are 5s. better at 11. Globe Ordinary at 14½ are also ½ up. A small recovery occurred in West India and Panama shares. The Indo-European Telegraph Co. maintains its dividend of 13 per cent., but the report just out shows that the dividend equalisation fund has been drawn upon for £24,500, the net profit having fallen from £59,000 to £22,500. This report is for 1917, and doubtless the directors see a more cheerful prospect for 1918, otherwise they might have reduced the distribution.

British Aluminium Ordinary have given way a little to 1½, and British Westinghouse Preference are 1/16 easier. Edison "A" shares show a slight recovery. Sales on behalf of a deceased account led to falls in Callender's Ordinary and Preference, but Henleys at 4 have recovered the dividend just deducted. Labour conditions continue to cramp enterprise in this section, and the same handicap applies also to shares in the armament and the iron, coal, and steel companies.

Telegraph Constructions have been an interesting market, the price mounting to 56½ before a few shares came in to check the substantial rise. The scheme for doubling the capital by the distribution of a bonus share for every share at present held has put up the price nearly £10 since the details appeared. What the dividend is likely to be on the doubled capital is now the question. The present 20 per cent. would automatically become 10 per cent., but as the company is a very rich one, and the business seems likely to expand rather than to remain stationary or to contract, some there are who look for the dividend on the new capital to be 15 per cent.—equal to 30 per cent. on the present basis. Time will show, obviously, but there is high confidence felt in the likelihood of the price improving even further, and, after removal of Treasury control on new issues, a splitting of the £12 shares into others of more popular proportions would enhance their value.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price March 4, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	77	—	£6 15 7
Charing Cross Ordinary	5	4	32	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	38	—	6 13 4
Chelsea	3	5	27	—	4 1 1
City of London	8	8	122	—	6 6 6
do. do. 6 per cen Pref.	6	6	104	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	104	—	5 16 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	8½	+ ½	7 8 0
do. 4½ per cent. Pref.	4½	4½	8½	—	6 18 6
St. James' and Pall Mall	8	9	7½xd	—	7 0 4
South London	5	5	9	—	6 18 4
South Metropolitan Pref.	7	7	80/6xd	—	6 16 7
Westminster Ordinary	7	9	6½xd	+ ½	6 13 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	98½	—	£6 1 10
do. Def.	1½	1½	21½	—	7 18 0
Chile Telephone	6	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	11	+ ½	*6 7 4
Eastern Extension	8	8	152	—	*5 1 7
Eastern Tel. Ord.	8	8	160½	+1	*4 19 6
Globe Tel. and T. Ord.	7	7	14½	+ ½	*4 16 7
do. do. Pref.	6	6	104	—	5 14 3
Great Northern Tel.	24	22	82	—	6 17 6
Indo-European	13	13	58	—	5 12 0
Marconi	15	20	4½	—	4 9 0
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7½	—	*5 1 7
West India and Panama	6d.	1/8	11	+ ½	*3 11 6
Western Telegraph	8	8	16½	—	*4 16 8
HOME RAILS.					
Central London Ord. Assented	4	4	69xd	—	6 6 0
Metropolitan	—	1	28½xd	—	4 7 9
do. District	Nil	Nil	25½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	8½	—	Nil
do. do. "A"	Nil	Nil	10/-	—	Nil
do. do. Income	6	4	90xd	+ ½	*5 7 6
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½xd	—	£5 11 4
Anglo-Arg. Trams. First Pref.	8½	8½	84½	—	—
do. do. 2nd Pref.	8½	—	8½	—	—
do. do. 5 Deb.	5	5	70½	—1	5 19 10
Brazil Tractions	—	—	83	—1	—
Bombay Electric Pref.	6	6	108	—	5 11 7
British Columbia Elec. Ry. Pfce.	5	5	68½	—2	7 17 8
do. do. Preferred	Nil	Nil	44	—2	Nil
do. do. Deferred	Nil	Nil	42	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	64	—	Nil
do. 6 per cent. Bonds	Nil	Nil	68	—	Nil
Mexican Light Common	Nil	Nil	30	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	69	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	25	—	£3 17 5
British Aluminium Ord.	10	10	14	—9d.	5 6 8
British Insulated Ord.	20	20	23	—	4 9 0
British Westinghouse Pref.	7½	7½	2½	— ⅛	6 3 0
Callenders	20	25	104	— ½	5 19 1
do. 6½ Pref.	5	5	3½	— ½	6 3 10
Castner-Kellner	22	20	8½	—	6 1 3
Edison-Swan, "A"	—	—	19/-	—9d.	—
do. do. 5 per cent. Deb.	4	4	74½	—	6 14 3
Electric Construction	7½	10	1½	—	8 0 0
Gen. Elec. Pref.	6	6	10½	—	6 6 10
do. Ord.	10	10	17½	—	*5 14 3
Henley	3½	2½	9½	—	5 8 2
do. 6½ Pref.	6½	6½	4xd	+1/6	5 12 6
India-Rubber	15	15	17	—	*5 17 8
Siemens Ord.	10	—	6A	—	*7 18 6
Telegraph Con.	20	20	56½	+2	*4 5 6

* Dividends paid free of Income Tax.

THE DETERMINATION OF THE EFFICIENCY OF THE TURBO-ALTERNATOR.

By S. F. BARCLAY, Ph.D., A.M.I.E.E., and S. F. SMITH, D.Sc., A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

WITH the methods ordinarily employed of establishing the efficiency of the turbo-alternator, the stray loss that is present on load is either deduced by a substantially conventional method, or is ignored altogether. As alternators for larger outputs are constructed, the stray loss becomes of greater importance. It is becoming impracticable to apply the existing methods to the very large alternators now being constructed; it becomes increasingly important, therefore, to introduce a method of establishing the alternator efficiency, which is based on the measurement of the actual losses on load.

The object of this paper is to show that the actual losses on load can be deduced conveniently and accurately from measurements of the cooling air flowing through the alternator; but that misleading results may be obtained unless certain precautions are taken in applying them.

The accurate determination of the alternator efficiency is the only means of ascertaining the magnitude of the actual stray loss; for if the total loss on load can be found, the stray loss can be deduced when the other losses have been measured separately. With turbo-alternators of even moderate size the stray loss may be as high as five or six times the ohmic loss in the stator copper. If the efficiency on load can be determined accurately, it will be one of the most important of the designer's informative tests.

The common practice in this country is to base the guarantees of the alternator efficiency on the summation of the various losses that can be measured separately, and either to ignore the stray loss altogether, or to employ a substantially conventional method of determining it. In the conventional method adopted by the American Institute of Electrical Engineers, and used by some manufacturers in this country, the whole of the stray loss present on short-circuit is included when computing the conventional efficiency of polyphase machines. That the nature and distribution of the loss under the two conditions may be quite different, however, is shown by studying the heating in the two cases. For instance, in the case of a 5,000-KW. alternator at 3,000 R.P.M., embedded thermo-couples showed a temperature rise of 250° F. at the ends of the stator core after running for an hour on short-circuit, although on full load the temperature rise of the same parts was only 60° F. When there is agreement between the values of the stray loss on load and on short-circuit it is partly accidental, and is not to be expected in all cases.

For some time past the authors have been investigating the subject in conjunction with turbo-alternators made at the Sheffield works of Messrs. Vickers, Ltd., and their investigations show that, provided certain precautions are taken, the alternator efficiency can be conveniently and accurately determined under actual load conditions from measurements of the cooling air. From such measurements the separate losses can also be deduced—a matter of considerable importance when a driving motor is not available.

Modern turbo-alternators invariably have forced ventilation, and with the exception of the relatively small amount of heat dissipated from the external surface of the stator, all the losses, except the bearing losses, are carried off by the cooling air. Consequently, the most obvious method of finding the losses on load is to ascertain, with regard to time, the heat energy that is being carried away by the ventilating air; for if the volume of air flowing through the machine in unit time, and the average increase of temperature that the air undergoes in absorbing the losses in the machine, are known, then the total losses on load can be calculated without difficulty. This method will hereinafter be referred to as the "air-heating" method. The principle involved in this method formed the subject of a paper on "The Testing of Electric Generators by Air Calorimetry," read before the Institution* in 1903 by Prof. R. Threlfall, the machines in this case being totally enclosed in a specially constructed housing.

An alternative method that does not involve measuring the air volume is to ascertain the increase in temperature of the cooling air caused by a loss of known magnitude in the alternator, and from the observed temperature rise of the air on load to deduce the total losses. This method will hereinafter be referred to as the "calibrated air-temperature" method.

The bearing losses may be determined fairly accurately by measuring the volume and temperature rise of the lubricating oil, and by making a suitable allowance for the heat dissipated in other ways.

Air velocity can be measured by the Pitot tube, the Venturi tube, electrical methods, and the anemometer.

The Pitot tube consists essentially of a dynamic tube placed in the line of air flow and a static tube with the plane of its orifice set at right angles to the line of air flow. The shape and size of the orifice of the dynamic tube have been found by careful experiment to be unimportant, but the size and position of the orifice of the static tube are most important. Tubes conveying the two pressures—*i.e.*, the dynamic and static heads—are connected to a differential fluid gauge. The difference of pressure that the gauge shows has been found to be proportional to the square of the air velocity over a very wide range. For the present purpose the average gauge readings are of the order of one-fifth of an inch of water, and for accurate work with such low pressures it is necessary to employ a special form of manometer with the tube inclined at a large angle to the vertical. The micro-manometer designed by Mr. B. J. B. Roberts is very exact, and has been employed by the authors in their investigations with excellent results.

The principal objection to the Pitot tube for this work is that when making absolute measurements it is dependent for its accuracy on the air flow being in line with the dynamic tube and at right angles to the static tube—conditions that cannot exist when the air flow is variable in direction.

The Venturi tube is a very exact instrument, but for its accuracy it is even more dependent than the Pitot tube on the flow of air being constant in direction, and it is, therefore, unsuitable for the present purpose.

The electrical measurement of air velocity has been successfully carried out. A wire of high electrical resistance-temperature coefficient, such as platinum, is employed, and either a constant voltage is maintained across it and the variation in resistance read, or the resistance is maintained at a constant value and the necessary variations of current are read. The air velocity is deduced from the readings on the basis of the law that with unvarying wind velocity the linear forced convection of a thin wire increases as the square root of the air velocity. A hot-wire velocity indicator operating on this principle has recently been devised by Prof. J. T. MacGregor-Morris. Four exactly similar wires of material having a high electrical resistance-temperature coefficient are arranged as a Wheatstone bridge. One pair of opposite arms of the bridge is exposed directly to the air current; the other pair is also in the air current, but is protected by being enclosed in thin-walled tubes of high thermal conductivity. This small bridge is attached to the end of a tube of convenient length, and the leads are carried inside the tube to a portable battery and to a milliammeter or millivoltmeter. The difference between the cooling of the arms of the bridge that are exposed to the air current and the arms that are shielded from it is indicated on the ammeter or voltmeter, which can be calibrated to read the air velocity directly. The indicator attains a steady reading in a few seconds, and in the form described it is suitable for measuring velocities up to about 2,000 ft. per minute. Such an instrument should be satisfactory for measuring the air discharge from a turbo-alternator, particularly since the accuracy would be little affected by the air having a non-stream-line flow, as must be the case to some extent. The anemometer is usually considered to be somewhat inaccurate, but for the purpose in view the authors have found that a well-made instrument, when properly handled, gives sufficiently accurate results. Further, on account of the air flow being variable in direction, the anemometer is probably better adapted to read the absolute value of the average velocity at a given point than are more exact instruments. The velocity of the air discharge from a turbo-alternator is of the order of 2,000 ft. per minute, and, with an instrument of the kind used by the authors, measuring about 2·6 in. over the tips of the vanes, the frictional effect is not more than 3 per cent. of the vane-wheel speed, so that even an appreciable error in the correction for friction has only a negligible effect on the result. The other inherent defect of the anemometer—the effect of inertia—is only of appreciable importance when the air flow is variable. The authors have checked the accuracy and consistency of the anemometer in various ways.

The first difficulty that the authors encountered in the measurement of the volume and temperature of the air was a consequence of the great variation in the velocity of the air at the discharge opening of the alternator, due to the essentially peculiar shape and disposition of the openings in the stator core and frame, and also to the rotation of the rotor tending to cause the air to discharge obliquely instead of vertically.

With the object of equalising the air flow a temporary discharge trunk of the kind shown in fig. 1 was fitted, and close-mesh expanded-metal baffle plates were fitted in the trunk, as shown in fig. 1. Although there was still some variation, yet if the anemometer readings were taken at fairly frequent intervals the average velocity could be found with a sufficient degree of accuracy. The resistance of the expanded-metal baffles to the flow of air was found to have no appreciable effect on the temperature of the alternator.

For the accurate measurement of the air volume it is desirable that the discharge opening should be divided into squares, not much larger than the overall diameter of the anemometer, by stretching thin cords across the trunk, as shown in fig. 1, and an anemometer reading should be taken over each square.

Starting and stopping errors can be diminished by moving the instrument rapidly from square to square without stopping it, and the average value of the air velocity is found by dividing the total reading by the number of squares. It is desirable to run the anemometer for an appreciable period over each square—15 seconds being the minimum desirable time.

The average temperature of the air can be found with sufficient accuracy by using one thermometer for each square and taking the average of the readings. The thermometers can conveniently be attached to the cords in a horizontal position. The determination of the average temperature of the inlet air presents no difficulty, but it should be verified that there is no external source of heat—such as a steam pipe—near the thermometers. When an air filter

* ELECTRICAL REVIEW, December 11th, 1903.

is used in conjunction with the alternator, the inlet temperature has to be read between the filter and the alternator, and it is particularly necessary to do so when the filter is of the wet type.

The average temperature of the air at the inlets and outlets can also be determined very accurately by measuring the change in resistance of a coil of wire, of which the electrical resistance-

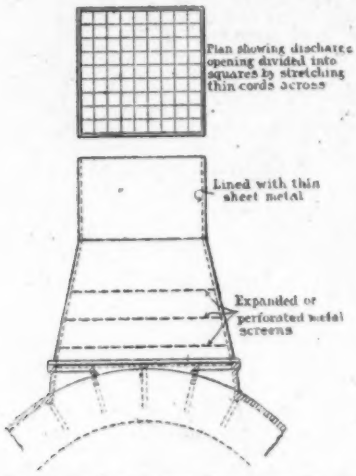

Plan showing discharge opening divided into squares by stretching thin cords across
Lined with thin sheet metal
Expanded or perforated metal screens

Fig. 1.—Temporary Discharge Trunk to Facilitate the Accurate Measurement of the Air Volume and Temperature.

temperature coefficient is known, mounted in the air flow. The precautions to be taken in the measurement of the air volume and temperature are simple, but without such precautions the authors have found that quite misleading results may be obtained.

The Determination of The Losses on Load by the "Air-Heating" Method.

The method of calculating the losses from the volume and temperature rise of the air will now be described. The value of 0·0711 lb. is taken for the weight of a cb. ft. and 0·242 for the specific heat of dry air at the assumed temperature of 100° F. and at an atmospheric pressure equal to 29·92 in. of mercury. The mechanical equivalent of heat is taken to be 778 ft.-lb. per therm.

Let V = volume of air leaving the alternator discharge in cb. ft. per minute,

T_i = average temperature of the air at the inlets,

T_o = average temperature of the air at the alternator discharge.

The heat energy being carried away by the air is then—

$$P = V \times 0{\cdot}0711 \times 0{\cdot}242 \times (T_o - T_i) \times 778 \text{ ft. lb. per minute,}$$

$$= V(T_o - T_i)/3{,}305 \text{ kilowatts} \quad \ldots \quad \ldots \quad (1)$$

where T_i and T_o are in degrees Fahrenheit.

The various corrections that may have to be made to the above formula are dealt with in an appendix. For commercial testing, corrections need be made only in the event of the air temperature or barometric pressure differing appreciably from the conditions assumed, and in respect of the heat energy that is dissipated from the stator frame (about 1·5 per cent.). Formula (1) may be amended to include the corrections as follows:—

$$P = V H (T_o - T_i)/174 (460 + T_o) \text{ kilowatts} \quad \ldots \quad (2),$$

where H is the atmospheric pressure in inches of mercury.

The Determination of the Losses on Load by the "Calibrated Air-Temperature" Method.

When the alternator coupled to a driving motor is being run at the works, the stator-core loss with various values of the exciting current can be measured—a test that it is always desirable for the maker to carry out for his own information. When the machine is being tested on site, the temperature rise of the cooling air is measured (1) on open circuit with the rotor unexcited, (2) on open circuit with the rotor excited to a known value, (3) with the alternator on load.

Let t_e denote the temperature rise of the cooling air in test (2) with the rotor excited, P_c the rotor copper loss, and P_i the stator core loss corresponding to this excitation (the value of P_i is given by the core-loss curve taken at the works). Then, if t_u denotes the temperature rise of the cooling air in test (1) with the rotor unexcited, it follows that the difference $t_e - t_u$ in the rise in temperature of the cooling air is caused by the known loss $P_i + P_c$ kilowatts. The loss in the alternator necessary to cause the temperature of the ventilating air to increase one degree is then—

$$\triangle P = (P_i + P_c)/(t_e - t_u) \text{ kilowatts.}$$

The quantity $\triangle P$ thus represents the calibration of the temperature rise of the cooling air of the machine in question.

If now t_l denotes the temperature rise of the cooling air in test (3) when the alternator is on load, it follows that the load loss will be—

$$P = \triangle P \times t_l \text{ kilowatts.} \quad \ldots \quad \ldots \quad (3)$$

The accuracy of the method depends mainly upon the weight of air flowing through the machine remaining constant whilst the heating tests are being made. The effect of losses in the alternator is, of course, to heat the air and cause it to expand, and so increase the volume for a given weight. The opposition to the flow of an increased volume of air will depend on the position of the parts where there is the greatest restriction to the air flow with respect to the position of the parts where the heating occurs. The load losses given by this method are somewhat too large, but the authors have estimated that even in radially-ventilated machines the losses are only 2 to 3 per cent. too high. This estimate is confirmed by tests. A general correction cannot be made in respect of this error, since it will be influenced by the system of ventilation. In the absence of accurate information it can be assumed that the losses obtained by the "calibrated air-temperature" method are 2½ per cent. too high.

TABLE I.—Comparison of Results Obtained by Four Different Methods.

Machine No.	Methods based on cooling air.		Methods based on "summation of losses."	
	"Air-heating" method.	"Calibrated air-temperature" method.	A.I.E.E. method.	Stray loss ignored.
5,862	352	362	336	211
7,001	327	338	315	255
7,541	46	47	52·5	42·8

Typical results obtained by the "air-heating" and "calibrated air-temperature" methods are given in Table I, compared with the "summation-of-losses" method as adopted by the American Institute of Electrical Engineers, and with this method when an allowance for stray loss is excluded.

General Conclusions.

These investigations have led the authors to the opinion that the "air-heating" method may quite well be adopted for the determination of the turbo-alternator efficiency for commercial purposes, with advantage to the purchaser and the manufacturer. By taking the prescribed precautions when measuring the air volume and temperature, the losses on load can be determined quite as accurately as is required, and probably more accurately than in any other way. From the manufacturer's point of view, a great advantage of the method is that a driving motor is not required—an item of importance when dealing with alternators of large output. Also, when on account of transportation difficulties the stator has to be built on site, in addition to measuring the total losses on load, the method could be employed to measure the separate losses with ease and accuracy.

The method is independent of tests made at the works, and in the event of dispute a check test could be made at any time.

The "calibrated air-temperature" method has the one advantage compared with the "air-heating" method that the air volume has not to be measured, but on the other hand, it has certain disadvantages. The efficiency cannot be determined solely by tests on site, and once the alternator has been dispatched from the works, a check test in the case of dispute cannot be made.

The "summation-of-losses" methods in present use which ignore the stray loss have little value.

The authors express their obligation to Messrs. Vickers, Ltd., for permission to carry out the experimental investigations, and to Mr. H. P. Hayhurst and his testing staff for the care that they have taken in carrying out the tests.

Discussion in London.

Prof. G. W. O. Howe, in opening the discussion, said he was glad to find a representative of the manufacturer and of a technical college collaborating as the authors of the paper they had just listened to had done; it was a good omen for the future. The problem of stray losses was a most serious and at the same time puzzling one. With the large size of machines now being built, these losses would demand very careful consideration, and he thought that when any tests were to be made it would first be necessary to run the machine for some time in order to allow the temperature to settle down before any readings were taken. He pointed out that on page 3 of the paper the law upon which was based the electrical measurement of air velocity was not given. Referring to the author's air discharge trunk, the speaker thought that, by electrical methods, an average measurement could be taken over the whole area at once, instead of having to take a number of measurements over the cross section by the author's method. He was not enthusiastic over the anemometer as a measuring instrument; in his opinion frictional difficulties would be encountered. With regard to the curves plotted from Pitot-ture readings taken at the opening of the discharge trunk, he did not see why the conditions should not be further improved so that one average reading could be taken for the whole surface. The authors employed a number of thermometers, but it was not stated whether the temperature varied very much. Here again he thought that an electrical method of measurement could be devised with advantage.

Mr. A. H. Law expressed pleasure that this method of testing had been brought before the Institution. He had advocated it for nine years, but everybody always maintained that accurate results could not be arrived at by such methods. He pointed out that an anemometer was usually

calibrated at normal air temperature, and stated that an error was introduced when the air temperature was raised, due, he thought, to the lubricant becoming more fluid. With the large size of machines that were now being built it would become necessary to carry out all tests *in situ*, and the difficulty of driving such large machines under these conditions at once became apparent. He showed a number of interesting slides illustrating the method adopted by his firm by which the generator was run up to speed by the turbine, after which the former was allowed to run as a motor. They coupled the two machines by means of copper plates fixed to the coupling flanges and driving against rectangular surfaces. These copper plates were tapered in such a way that when the required speed was reached the coupling parted, and the copper, being a soft metal, was worn away, thus disconnecting the two machines. Another side showed that, by suitably arranging conditions, a test of a large generator could be commenced at 9 o'clock in the morning and completed by 5 o'clock in the evening of the same day.

Prof. J. T. MacGregor-Morris explained the principle of a hot-wire, air-velocity indicator recently devised by himself, and which was referred to in the paper; he showed slides illustrating experiments he had carried out with the instrument on the East Coast, which should that it was portable and not easily damaged, the whole apparatus having been carried several miles on a bicycle. Referring to the "air-heating" method of determining the losses, he explained that the pressure was not great over the whole, and he thought a measurement of the average temperature over the whole area could be taken quite easily. The formula given on page 7 of the paper for this method could in reality be reduced to 2 measurements—temperature and volume. He did not think it would be a difficult matter to devise two instruments to take these two measurements, and the problem would then be quite simple.

Prof. E. W. Marchant thought that the most important point brought out by the authors was that the stray losses could be so great. In the past they had devised means of measuring various losses very carefully, but these stray losses could be so great that he thought they would have to start all over again and attack the problem afresh. He described air-blast cooling tests that had been carried out by Mr. Teago at Liverpool University. A fluid gauge that was used consisted of a U-type, the open ends of which were formed into cups. One arm of the tube contained water coloured with methyl orange, and the other a mixture of chloroform and toluol. The density of the latter mixture being the same as that of water an indicator was thus provided which could be read, the variations of the readings on the arm of the U-tube being magnified something like 100 times those in the cup. This gauge had been used with success in connection with tests on transformers. He had no faith at all in the anemometer, and thought some other instrument could have been chosen in its place.

Major A. M. Taylor pointed out that the error incurred in measuring the total loss was the error incurred in measuring the stray loss, provided the "known" losses were really accurately known (since the stray losses were obtained by a process of subtraction), and provided that the stray losses were quite a large proportion of the total losses. Taking the authors' figures for the various errors investigated, it would seem as though the aggregate error in the measurement of the total losses would not be likely to exceed 8 to 10 per cent. It was well to bear in mind that the loss being investigated was about 1 to 1½ per cent. of the output of the alternator. Compared with the less-known losses occurring on the steam side, it might seem to steam engineers rather like splitting hairs to be analysing such losses as these, and the question arose whether the talents of the authors would not be better directed to analysing the steam losses, which aggregated from 15 to 20 per cent., and did not seem to readily lend themselves either to exact measurement or calculation. As regarded the employment of the perforated metal screens shown in fig. 1, he would suggest that if a series of guiding blades—like the blades of a turbine—were designed to transfer the right-to-left components of the velocity of the air, without shock or undue friction, into vertical components, the same results might be attained without the throttling effect which was to be expected with these screens. With reference, again, to the losses occurring on the steam side, he asked whether it would not be possible to measure some of these losses by electrical methods.

Mr. C. C. Paterson pointed out that a considerable amount of heat might be lead away into the ground through the bed plate and foundations of the generator; this would naturally affect any tests that were made, and he inquired whether the authors had taken it into account or whether they considered the amount of heat so dissipated as negligible.

Dr. F. T. Chapman made similar inquiries as to the heat which might be transferred to the generator from the steam turbine by means of the bed plate, &c.

Mr. Ll. B. Atkinson said it would be a waste of time to take numerous readings by means of an anemometer all over the cross section of the air discharge trunk as advocated in the paper. In his opinion a deflection instrument should not be difficult to devise by which an average reading for the whole area could be measured. This deflection instrument could be calibrated with an anemometer, after which the latter could be dispensed with.

Other speakers drew attention to the fact that when such low pressures were to be measured it was difficult to attain any degree of accuracy. Pitot tubes were considered to be unsatisfactory, and experiments with the inclined-tube method showed that it was difficult to obtain consistent results. Prof. Threlfall's instrument was preferred; this was a most difficult instrument to use properly, but when so used gave good results.

Dr. S. P. Smith, replying to the discussion, said that a standard method of determining losses was very desirable. It was a matter of surprise, considering the amount of work that had been done on the subject as revealed by the discussions, that the present paper had not been written a good deal earlier than it had been. Referring to the curves plotted from Pitot-tube readings taken at the air-discharge trunk, he said that the problem was entirely different to that which air-channel experts had to deal with. They quite realised the defects of the anemometer, and they had expected to have to face much criticism, but in spite of its shortcomings, was there a more suitable instrument available? A number of valuable suggestions had been made in the discussions, and they would be made use of. Stray losses could be very large, and it was of the utmost importance that they should be reduced to the minimum. Of course, a steady temperature was necessary before any readings could be taken, but Mr. Law had shown that a good deal could be done to shorten the time taken to carry out tests. Suggestions that an average in place of individual readings could be taken over the area of the air-discharge trunk would simplify tests, and the problem was being considered, but there was considerable variation of the air temperature over the area of the trunk depending on the method of ventilation adopted. He was glad to have Mr. Law's experience and his explanation of his method of running a rotor up to speed. It was true that stray losses could be found by eliminating other known losses.

THE FARADAY SOCIETY.

The Present Position of the Theory of Ionisation.

At its January meeting the Faraday Society held a general discussion on the present position of the theory of electrolytic dissociation. The chair was first taken by the President (Sir Robert Hadfield, Bart., F.R.S.), and subsequently by Prof. Alfred W. Porter, F.R.S. (one of the vice-presidents), who also contributed one of the papers. The opening address—broadly surveying the subject—was given by Prof. G. Senter, and an important communication, summarising the evidence now available in support of the theory, was sent from Stockholm by Prof. Svante Arrhenius, the founder of the theory, who, under normal circumstances, would have been present in person.

The theory of ionisation was originally postulated to explain the anomalous behaviour—as regards vapour pressure, osmotic pressure, freezing points, and conductivities, for example—of electrolytes in solution, and it supposes that in the act of solution these are split up or dissociated into ions, the percentage amount of dissociation depending on the dilution of the solution. If this be the case, however, where dissociation is incomplete, there should be a certain relation between the quantities of dissociated and undissociated solute present, determined by the well-known law of mass action. In the case of strong electrolytes this relationship has been found not to hold good, and much of the discussion centred round this phase of the dissociation problem. Prof. Arrhenius took the view that more experimental work remains to be done before we know what precisely are the deviations that call for explanation. Prof. S. F. Acree, of Syracuse University, U.S.A., in a paper which will be referred to again, incidentally emphasised the importance of the highest technique in experimental methods of determining concentrations of ions and molecules, otherwise any laws deduced are open to doubt; and Dr. E. Newbery even went so far as to throw doubts on the whole experimental basis of results based on conductivity measurements of solutions, which frequently eliminate "transfer resistance," namely, that part of the irreversible resistance of an electrolytic cell which is concerned with the transfer of the current from electrode to electrolyte. It happens that the latest experiments on strong electrolytes in which "ultra-pure" water was employed and every possible precaution taken, show these to obey the mass law in very dilute solutions, in accordance with the prediction of Arrhenius. Various suggestions have been put forward to explain the deviation in the case of concentrated solutions, but none of them is conclusive, and the problem must be considered to be *sub judice*. The theory that the solvent itself may be ionised was disposed of by Capt. J. W. McBain, while a recent view that salts are completely ionised even in strong solutions, and that the apparent increase of ionisation in dilute solutions is due to the operation of electrical forces, was acutely criticised by Capt. J. R. Partington, who concluded that it is not yet established whether deviations at high concentrations are due to the ions or to undissociated salt, or to both.

The problems of strong electrolytes ultimately hangs on conceptions of the mechanism of electrolytic ionisation, and this brings us to the important question of the hydration of the ions, which was dealt with by many contributors to the

discussion. When the last debate on this subject, some few years ago, was held by the Society, the view was generally adopted that not only were the ions hydrated, that is, associated with some molecules of the solvent, but that this association was the very cause of ionisation. Experimental evidence since accumulated does not, however, support that view. Mr. W. R. Bousfield has spent much ingenuity in calculating the amount of hydration of ions by applying to them Stokes's famous law relating to the movement of small spherical particles through a viscous liquid, but Dr. Henry Sand disputed the validity of this assumption, and Dr. F. H. Lindemann showed that even if Stokes's law were applied, it would have to be with a different constant, and if so, no evidence of hydration had been forthcoming. On the other hand, Prof. J. C. Philip, from a consideration of Kohlrausch's study of variations in ionic conductivities, reached the conclusion that ions must be hydrated.

This phase of the subject is assuredly still *sub judice*, and we look forward to a third Faraday symposium to relieve our perplexities.

Another aspect of ionisation referred to by many speakers, following Prof. Arrhenius, was the catalytic action of electrolytes in accelerating velocities of reaction. It used to be held that the ions only are the active chemical factors in solutions, but Dr. Senter and Prof. Acree have shown that undissociated molecules are also chemically active, and this would go far to explain why neutral salts accelerate the catalytic activity of strong acids. Another view, favoured by Arrhenius, is that the presence of the undissociated salt increases the osmotic pressure and thus the chemical activity of the reacting ions.

The interesting question of the nature of the interionic electrical forces in electrolytes was dealt with in several contributions, notably by Dr. S. R. Milner, who considered that the electrical theory was capable of accounting in a general way for the characteristic features of the ionisation of strong electrolytes. Dr. Lindemann showed that the energy necessary for dissociation depended on the dielectric constant of the medium—which was of the same order as its dielectric constant in bulk—while Dr. H. M. Dawson, going a step further, ascribed the anomalies of strong electrolytes to the disturbing effect on the ionising power of the solvent medium induced by these highly polar compounds of great dielectric capacity. We could have wished that more attention had been paid to this fascinating side of the ionisation problem.

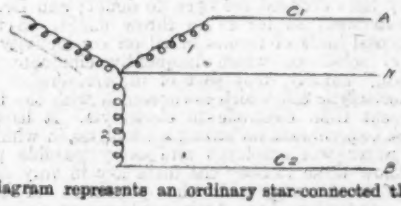
A practical note was sounded by Mr. G. L. Addenbrooke, who discussed the possible bearing of ionisation on some of the properties of dielectrics he had been investigating. He had found, for example, that the absorption of electrical energy in dielectrics, excluding that energy which was reversibly stored, was due to the presence of moisture, and was probably electrolytic in character. One only arrived at the true dielectric constant after eliminating the effects due to moisture. On plotting the dielectric constants of a large number of elements and compounds against other physical properties a definite grouping became manifest. A tentative explanation was indicated of these and the absorption phenomena in terms of the modern theory of the electronic and ionic constitution of matter.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Three-phase Problem.

Recently I had occasion to find a solution to the following little problem :—



The diagram represents an ordinary star-connected three-phase system.

A and B are wires connected to two of the phases.

N is a wire connected to the neutral or star point, acting as common middle wire to the two phases.

The question was to find a formula for the current passing in the middle wire N.

Dealing with the problem by the usual trigonometrical methods, I made out the working as follows :—

If C_1 = current in phase 1 and C_2 = current in phase 2, the current in N = $C_1 \cos 30^\circ + C_2 \cos 30^\circ$.

When the load is balanced and $C_1 = C_2$, this reduces to :—

Current in neutral = $2\ C_1 \cos 30^\circ = \sqrt{3}\ C_1 = 1{\cdot}7\ C_1$.

Giving as the general formula for any case, whether the load is balanced or not :—

Current in neutral = ·866 (current in phase 1 + current in phase 2).

I am told that my calculation is wrong. Will some three-phase expert either confirm my working, or kindly correct it where necessary? I am, of course, aware that the connections shown are unusual.

February 24th, 1919. W.

[If the currents C_1 and C_2 are equal, the resultant current in the common return

$$= C_1 \cos 60^\circ + C_2 \cos 60^\circ = \tfrac{1}{2} C_1 + \tfrac{1}{2} C_2 = C_1 \text{ or } C_2.$$

If C_1 and C_2 are not equal, the resultant current can be found as a diagonal of a parallelogram of which C_1 and C_2 are adjacent sides at an angle of 120°; or from the general formula

$$C = \sqrt{C_1^2 + C_2^2 - C_1 C_2}.$$—Eds. Elec. Rev.]

The Re-settlement of Officers.

With reference to the letter from "Warrant Officer R.E." in your issue of recent date, may I say a few words with regard to the efficiency of the Royal Engineers? Your correspondent seems to have lost sight of the fact that the "Sappers" also played some part in our electrical operations during the war.

Personally, I think that any lack of technical ability was due to the fact that the positions of authority were in many cases given to officers and N.C.O.'s who were totally unsuitable for the work. As an instance, I was one of a party of 75 men which included 10 B.Sc. (Eng.) and many other technical men, who were commanded by an officer who, in civil life, was a comedian of some repute.

I hope this glaring instance may serve to explain to some extent why our technical corps did not achieve greater wonders.

Ex-Sapper.

Telephone Calls at the Patent Office Library.

I should like to suggest, through the medium of your journal, that it would be a very great convenience to regular users of the Patent Office Library if arrangements could be made whereby such users could be called by telephone from their offices.

To this end, I would recommend the placing of the public telephone in or near the booth of the attendant immediately outside the library, and that he should be provided with a book of tickets after the style of cloakroom tickets. One of these tickets could be purchased, say, for a penny, by a person entering the library; the counterfoil, with his name thereon, being kept by the attendant.

By this means a business man, having to go to the library—and many have to spend hours there—could be communicated with from his office by telephone, the procedure being as follows :—

On the attendant receiving an inquiry for Mr. Blank, he would look among his counterfoils for that name and, finding it, would communicate to the attendant within the library, by 'phone or otherwise, the number on Mr. Blank's counterfoil. This number would be called out, giving Mr. Blank to understand that he was required on the telephone. Persons making use of the service would be required to surrender their tickets on leaving the library.

The fee could be adjusted so as to make the service self-supporting were it so desired; but, having regard to the profits made by the Patent Office, this would not seem to be important.

A. H. Moore.

London, E.C., *February 28th*, 1919.

Early Wireless Telegraphy.

My object in writing to you on this subject on January 25th was to defend the late Sir William Preece against what seemed to me the very unfair suggestion that had been made in your columns that Mr. Marconi, when he first arrived in this country, failed to meet with sympathy in official circles, and I am glad to see that Mr. Marconi entirely agrees with my correction in this respect.

I notice, however, that Mr. Marconi goes on to find fault with my statement that the assistance which he received from the Post Office "included the use of a considerable sum of public money."

With regard to this, of course, I have never suggested at any time that actual payments were made by the Post Office to Mr. Marconi, but in order to remove entirely this idea, which, though never put forward by me, appears to have existed, I may state that I have a recent letter from Sir John Gavey in which he writes :—"To my knowledge, no monetary transactions of any kind took place, nor were any payments made by the Post Office to Mr. Marconi during the period that we were working in association."

This, however, does not in any wise affect what I did state in my letter to you, which was that the Post Office gave to Mr. Marconi "much technical assistance, including the use of a considerable sum of public money which was expended in developing wireless telegraphy by numerous experiments carried out with the help of Post Office officials, including Mr. (now Sir) John Gavey." Of course, opinions may differ as to what sum of money may be described as considerable; but that substantial sums of public money were expended,

and considerable technical assistance given by the Post Office to Mr. Marconi in the manner I have stated is borne out by a printed official report by Sir John Gavey written in 1903, which I have before me, in which an account is given of the experiments "instituted by the British Post Office" for the purpose of investigating Mr. Marconi's method, beginning in May, 1897, and in which it is specifically stated that "the apparatus used at this time was partly Marconi's own gear and partly modified and re-designed appliances made in the Post Office workshops or purchased by the Department." The report proceeds to give detail of "the masts of rather over 100 ft. total height," and of induction coils and other apparatus and materials which the Post Office provided, and in some cases specially purchased for the purpose. Further, Sir John Gavey in his recent letter to me, writing of "such Post Office funds as were expended on Mr. Marconi's wireless experiments," states that these were utilised "to meet the cost of materials, labour, and travelling expenses of Post Office engineers in carrying out distant experiments, notably those across the Bristol Channel, where three temporary wireless stations were erected, manned, and subsequently removed, by the Post Office staff."

A. A. Campbell Swinton.

London, S.W., *March 3rd*, 1919.

A Protective Association for Non-Technical Staffs.

I fully endorse "Accountant's" letter in your last issue suggesting affiliating of smaller Associations to the E.P.E.A., but suggest that the E.P.E.A. cater for all non-technical staffs in electrical and tramway undertakings. There are many members of these staffs for which no association caters, and I am confident that if such were included they would be a source of strength to the E.P.E.A. Personally, I am on the eve of joining the Tramwaymen's Union, the only Union at present that is of any use to non-technical staffs. If the E.P.E.A. would take the initiative and form an association to embrace these outside elements I have no doubt of its success.

Three Spires.

March 1st, 1919.

I have followed with interest the correspondence which has appeared in the Electrical Review. Small sectional organisations are out of date, and cannot be expected to protect the interest of their members. The National Union of Clerks is over 40,000 strong, and is developing the guild method of organisation. This method gives each section of clerks the advantage of a sectional organisation without the disadvantages. The electrical clerks' section or guild of our organisation could come to an arrangement with the E.P.E.A. in the same way as the Iron and Steel Clerks' Section, or Guild, has come to one with the Iron and Steel Confederation. We are in a better position to come to arrangements with other organisations than a small sectional organisation.

"Another Supporter" does not realise that the National Union of Clerks has come to the same arrangement with the Railwaymen's Union as the Railway Clerks' Association. In fact, the Railway Clerks' Association is affiliated to the National Union of Clerks in the same way.

At the present time we need more organisation and fewer organisations, and I appeal to the power clerks to assist us to build up a powerful organisation representing all clerks, which will, at the same time, ensure full protection to the various sections by federating them to their industrial unions. This is a scientific method of organisation, and it only requires the necessary membership to secure complete success.

Ben Griffiths,
Welsh Organiser,
National Union of Clerks.

Cardiff, *February 24th*, 1919.

An Association for Technical Staffs.

Would you or any of your readers be good enough to inform us if there is any association incorporating the technical staffs of electrical manufacturing companies, such as estimating, designing, and testing staff. There is, of course, the Association of Engineering and Shipbuilding Draughtsmen, but unfortunately most of those mentioned are not eligible for this. It is admitted on all sides that the staff men have had the least consideration of any branch, and to receive attention to just demands it seems imperative to make combined efforts.

We are pleased to notice in your columns that the E.P.E.A. is obtaining substantial recognition, but presume that this Association confines itself to officials at generating stations.

Five of Them.

February 27th, 1919.

[It is an open secret that a very big movement is on foot to form an association of the type referred to by our correspondent, and we understand that it will shortly make its début.—Eds. Elec. Rev.]

Electrical Engineering in the Army.

I have read with interest your leading article on "Electrical Engineering in the Army," also the correspondence arising thereon. I think the following brief outline of the system employed at one of our Bases for supplying electric light and power to hospitals, camps and workshops may prove of interest to your readers. The area is divided up into two districts, North and South, and each district into six divisions. At the central distributing point of each division, a static transformer is installed, the transformers ranging from 25 K.V.A. to 250 K.V.A. The current is received from the French supply company at 5,500 volts, and transmitted to the various sub-stations by means of a three-core cable laid underground, and passing in and out of each sub-station. There are two separate cables, one going north and the other south, the approximate length of cable laid being 10 miles. The L.T. supply of 210/125 volts, 3-phase, 4-wire, is transmitted from each sub-station to supply the division, four circuits being employed, North, South, East, and West. The outgoing mains are controlled by four tripolar switches and 12 S.P. fuses, a copper link being used for the neutral, which is earthed at the transformer. The lighting load is balanced between the three phases and neutral, and a three-phase, 210-volt, 50-cycle supply used for power. Periodical readings are taken at each sub-station, and the out-of-balance current is kept within 1 per cent. at the average maximum load. In the hospitals, each marquee ward is provided with electric light, whilst the hutted wards have, in addition, special connections for the use of radiant heat and light baths. For the operating theatres, special fittings are made for the operating tables, eye and throat work, and the X-ray departments are provided with an up-to-date installation for taking instantaneous photographs. In the camps, huts and messes are electrically lighted, whilst in the workshops extensive use is made of the supply for power.

M. M. E.

France, *February 12th*, 1919.

Engineer Surveyors' Salaries.

Mr. Forsyth's letter concerning insurance surveyors' salaries is not quite correct, namely, £360. Presuming this to include the war bonus, which he does not mention, it is still in excess of the actual remuneration of at least one of the old surveyors of over 10 years' service. Perhaps he will kindly correct the above figures, or, better still, practise what he preaches.

Ultra.

March 2nd, 1919.

How NOT to Obtain a Situation.

At this time, when so much is being said and so many articles written on the subject of employment, not only as regards men about to be demobilised but also civilians, I think it would be very advisable if prospective applicants gave more attention to the method of applying for a position than is generally the case at present. It has been my lot for some time to examine applications and fill vacancies on behalf of certain electrical undertakings, and the more I have to deal with this work the more I am led to believe either that the engineering profession contains a large number of fools or that carelessness and indifference are the most striking points in the character of a number of its members. While it must be admitted that many men send in applications that are excellently drafted, at the same time it is appalling to see the style in which a large number are composed. Some applicants give no details whatever of past experience, but write in a general rambling way; others give so little information of any sort that, after reading the application, all one is really aware of is the applicant's name and address. It has been my custom when inserting adverts in any paper to state as clearly as possible the nature of the training and experience required for the particular job, and to ask applicants to state age, full details of experience, &c.; but, on going through the replies received, I invariably find that a large percentage contain no information which would be really useful to a prospective employer in deciding as to a suitable applicant. I could give many instances, did space permit, but two which occurred recently will show what I am sorry to say is becoming a type instead of an exception: In one case the vacancy was for a shift engineer, and amongst the replies was one from a man who started by giving his age and then, after mentioning where he was employed at the time, stated, "I have been here ten years, so that ought to be good enough recommendation for anyone." I think it must be obvious that although the applicant may have been a good man, at the same time a man might be ten years in a certain job simply because his qualifications did not entitle him to a better position. The other instance was an application which consisted solely of a copy of the advert. and the following words: "I beg to apply, and hope my application will be considered." If this evil was only met with amongst the younger members of the profession, one might say that it was due to mere impulsiveness or lack of thought, but unfortunately amongst older applicants it is also common. I saw an application some time ago for a resident engineer's position from a man who held a university degree, in which, after a few vague statements, these words occurred: "I feel confident that I am the very man for the post, and could run the works as no one else could." I apologise for trespassing so far on your space, but I feel that some attention should be called to this question, and I am sure there are many engineers who could state similar facts.

Static.

February 28th, 1919.

Electrified Seed.

I quoted Dr. Mercier's own words, "Mountains of sugar and rivers of rum"; and now he says, "but I never used the phrase he attributes to me"! May I again ask for a reference to the author of the phrase?

We shall get at some of the facts if we make the best of what can be drawn out of the learned doctor, who tells us that "in each acre some 130,000 plants were subjects of experiment." This works out at about 27 plants per square yard; and it would be interesting to learn how many untreated *seeds* were sown to the square yard—also how many *plants* grew from what the birds left? Did Dr. Mercier know that birds prefer untreated seeds?

I am more anxious to get at the truth than "to catch Mr. Fry tripping," for he is quite able to take care of himself; and perhaps Dr. Mercier will kindly inform us *how many* treated and untreated seeds go to the bushel.

March 1st, 1919. **Wide Awake.**

The Future of the E.T.U.

As a member of the Newcastle Central Branch of the E.T.U., I feel it is necessary from the point of view of truth and honesty to enter an emphatic protest against your leading article in your issue of February 21st. You ask: "What is the matter with the E.T.U . . . The facts are notorious." "During the war the E.T.U. admitted to membership every Dick, Tom, and Harry that it could induce to enter, no matter how nebulous or remote his claims to electrical qualifications might be," &c. Now, I wish to bring to your notice the fact that the E.T.U. extends far beyond the environs of Ludgate Hill; consequently as a member of this northern branch and district, I unhesitatingly condemn your assertion as a lie. I challenge anyone to prove this to have happened in this branch and district. Your reference to the union "advertising itself as an efficient umbrella for those wishing to evade military service, &c.," may very well be passed over with contempt. Our head office do not possess an imposing roll of honour, but had they one, I am confident it could be well filled with the names of our members. Also many of those "highly skilled men who uphold the dignity of their calling" might, incidentally, have been "war-shy," and glad of the anti-military umbrella. It would be interesting to know how this portion of your leader affects the I.E.E. and the E.P.E.A. You also deplore the action of certain extremists in the E.T.U. in embarking upon this "foolish policy." What union is without this element to-day? What is the main cause of the chaos at present existing in the industrial world? I would refer you to the insane, panic-stricken attitude adopted by the Government at the outbreak of war towards the National Executives of organised labour throughout the country. When these executive were forced to sign the agreement with Mr. Lloyd George to forsake their privileges and their discipline over their various bodies, the extremist in the rank and file secured his chance. The National Executives for four years have been bound hand and foot by the Government, with the consequence that discipline and moral authority is a non-entity throughout organised labour. Towards the end of your article, it is very easy to discern your concern for the "really good men" in the E.T.U. I am frank enough to say that nothing would give you greater pleasure than to see a split in the ranks of the E.T.U., as a "Correspondent" suggests. But I am sanguine enough to say that the E.T.U. will weather this illness, even should it need the application of the surgeon's knife, but I am afraid those counting upon a post-mortem will be woefully disappointed. Regarding your E.T.U. correspondents who shelter behind the contemptible *nom-de-plume*, to throw their squibs at their "fellow members," I would remind them that if only they possess the manliness and honesty, they have branches in which their grievances may be ventilated and remedied, and a journal which will circulate their literary efforts throughout the kingdom. In conclusion, I trust you will publish this letter in the interest alone of truth and justice, as good journalism is usually held to be above prejudice and falsehood.

M. Boyle.

Newcastle-on-Tyne, *February 27th*, 1919.

[No doubt some branches of the E.T.U. are all that could be wished; but there are others. The claim of the E.T.U. to be a refuge from military service was recorded in the "Branch Notes" of the *Electrical Trades Journal* of September, 1917 ("Our slogan should continue to be that membership of our Union carries with it exemption from military service"). In our issue of November 16th, 1917, Mr. Webb stated that the above quotation, written by himself, represented the feelings of his Committee and the Union; incidentally, in the same letter he said that our comments had "always borne the imprint of fairness and tolerance." We do not wish to see the E.T.U. destroyed—we wish to see it a real electrical union, under wise and temperate leadership; as a matter of fact, our criticisms have been directed mainly at the London Branch, which seems to be the turbulent element. It will be remembered that at the meeting at the Albert Hall in December last, Mr. Lansbury attributed to the Electrical Trades Union the function of storm-troops to go "over the top" and lead the other unions in the proposed revolution. How many of its members want to do that? Are they willing to be the cat's-paw?—Eds. Elec. Rev.]

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

3,370. "Insulated joints for electric conductors." E. A. Walshaw. February 11th.

3,372. "Apparatus for obtaining continuous or direct-current from alternating-current circuit." A. Boffi et Cie. February 11th. (Switzerland, February 15th, 1918.)

3,407. "Electric switches." Cable Accessories Co., A. Crawford & F. H. Reeves. February 12th.

3,415. "Spark gaps for electromagnetic wave signalling systems." F. Lowenstein. February 12th.

3,414. "Sparking plug." H. Benoist. February 12th. (France, December 26th, 1917.)

3,419. "Producing and selectively transmitting harmonics of electric oscillations." Western Electric Co. (Western Electric Co., U.S.A.) February 12th.

3,428. "Ignition in internal-combustion engines." H. Brooker, P. A. Garrett & R. H. Moore. February 12th.

3,456. "Electric welding." British Arc Welding Co. & E. F. Spanner. February 12th.

3,462. "Receiving circuits for wireless telegraphy." H. J. J. M. de Regnauld de Bellescize. February 12th. (France, April 29th, 1918.)

3,476. "Electromagnetic relays." N. Bladen, and British L. M. Ericsson Manufacturing Co. & A. E. Sutherland. February 13th.

3,528. "Electricity meters, &c." M. Anninger. February 13th.

3,537. "Apparatus for indicating amount of electric current passing through a network box link, &c." A. F. M. Gatrill. February 13th.

3,552. "Starting mechanism for internal-combustion engines." H. E. Weller & T. Weller. February 13th.

3,555. "Electric arc furnaces." W. E. Moore. February 13th.

3,556. "Furnace-charging apparatus." W. E. Moore. February 13th.

3,559. "Evacuation of thermionic tubes, &c." Osram-Robertson Lamp Works & C. F. Trippe. February 13th.

3,560. "Electric mercury switches." A. K. Toulmin-Smith. February 13th.

3,562. "Electro-mechanical means for maintaining a platform or body in a ship parallel with the horizon." H. E. Rorke. February 13th.

3,569. "Electrical oscillatory circuits." W. J. Lyons & Selective Signal Co. February 13th.

3,592. "Electric lamps." Edison Swan Electric Co. & P. Freedman. February 13th.

3,601. "Device for destroying rats, mice, &c., by electrocution." J. Fell. February 13th.

3,619. "Thermic telephones, &c." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. February 14th. (Germany, February 15th, 1918.)

3,620. "Apparatus for manufacture of thermic telephones, &c." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. February 14th. (Germany, February 15th, 1918.)

3,641. "Electric couplings." W. C. Lea. February 14th.

3,642. "Manufacture of electrodes for soldering and depositing metals by the electric arc." Alloy Welding Processes, Ltd., & E. H. Jones. February 14th.

3,645. "Protective devices for electrical circuits." Western Electric Co. (Western Electric Co., U.S.A.) February 14th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

14,516. Dynamo-electric machine for transforming alternating current into continuous current or vice versa, and applicable also as a double-current generator. La Cour. October 14th, 1914.

1917.

6,642. Sparking plugs. T. Crosbee & Sons, T. S. Rogers & H. R. Wilks. May 10th, 1917. (122,654.)

12,051. Means for communicating to and from aircraft. T. Harvey and T. G. Tulloch. February 21st, 1918. (122,657.)

12,938. Insulation of the windings of electrical machines and apparatus. R. L. Cleaver & Sandycroft, Ltd. September 10th, 1917. (122,659.)

15,583. Automatic arc lamps. W. Engelke. October 26th, 1917. (122,660.)

15,978. Dynamo-electric machinery. Electromotors, Ltd., B. Longbottom and E. Greenhalgh. November 2nd, 1917. (Addition to 999/17.) (122,665.)

19,023. Signal devices applicable as stopping and turning indicators for vehicles. E. B. Roedding & E. Roedding. December 22nd, 1917. (122,670.)

19,331. Systems and apparatus for the electric transmission of power. E. M. Fraser. December 31st, 1917. (122,675.)

1918.

534. Sign telegraphs and other like electrical advertising devices. H. K. Harris. January 9th, 1918. (122,676.)

1,193. Mechanical movements for electric switches. J. W. McKenzie (Despard and Gordon). January 21st, 1918. (122,682.)

1,620. Dynamo-electric machines. H. Pieper. January 28th, 1918. (122,689.)

1,627. Dynamo-electric machines. Submersible & J. L. Motors, Ltd., and H. K. Whitehorn. January 28th, 1918. (122,690.)

1,632. Dynamo-electric machines. Submersible & J. L. Motors, Ltd., and H. K. Whitehorn. January 28th, 1918. (122,691.)

1,765. Electrodes of electric batteries. M. Robin. January 30th, 1918. (122,697.)

1,929. Generation of power, light, and heat from the sea tides. J. W. Seckerson. February 2nd, 1918. (122,706.)

2,116. X-ray fluorescent screen attachment for the localisation of foreign bodies. W. J. Barnicoat. February 6th, 1918. (122,711.)

2,526. Apparatus for producing flashes by the electric volatilisation of fusible wires. J. Courtier & P. Courtier. February 12th, 1918. (122,719.)

5,009. Dynamo-electric machines. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 21st, 1918. (122,741.)

5,381. Automatic telephone systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co., U.S.A.) March 27th, 1918. (122,747.)

6,055. Bases for incandescent electric lamps. H. C. Ghijsen & Naamlooze Vennootschap Vitrite Works. April 9th, 1918. (122,558.)

6,215. Telephone receivers. E. M. C. Tigerstedt. March 31st, 1917. (114,850.)

6,817. Method and means for protective apparatus on alternating-current system. A. G. Collis and Crompton & Co. April 23rd, 1918. (122,344.)

8,811. Overload electric switches. P. G. van Wijk. March 7th, 1918. (122,550.)

8,867. Electrically-heated preforator. A. B. Campbell. May 29th, 1918. (122,771.)

9,430. Electrical installation systems. Ateliers H. Cuénod Soc. Anon. June 21st, 1917. (117,445.)